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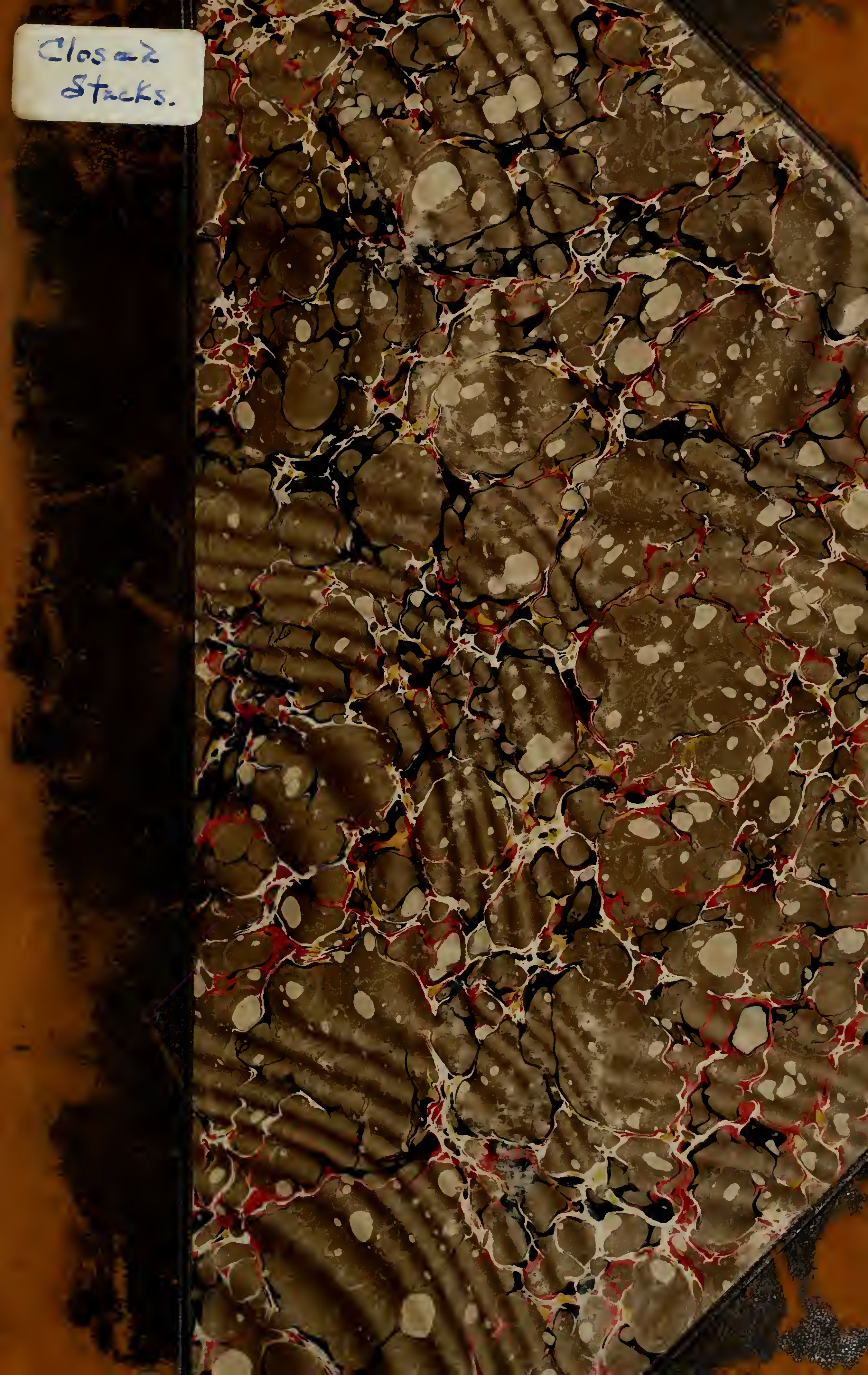

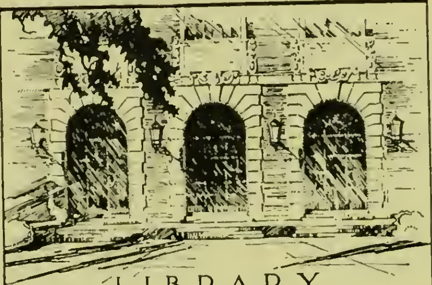

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BY

CHARLES J. MAYNARD.

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VOL. I. APRIL, 1889. No. 1.

NEWTONVILLE, MASS.:
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The present number of Contributions to Science contains, in addition to the four colored plates, many wood-cuts amply illustrating several ofthe principal articles. This will form a more marked feature in the forthcoming numbers.

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CONTRIBUTIONS TO SCIENCE.

BY

CHARLES J. MAYNARD.

Vol. I. April, 1889. No. I.

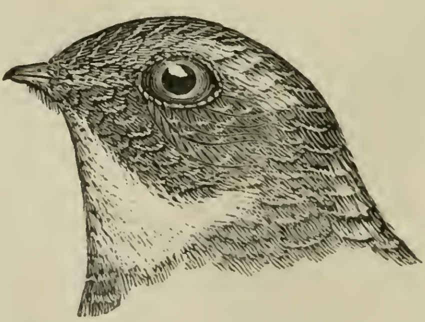
PREFATORY.

The appearance of the first number of Contributions to Science, is the beginning of the realization of a project that I have had in mind for many years, but which various circumstances have prevented me from attempting, until the present time. I have long felt the need of some organ wherein I could publish papers upon various scientific subjects, where they would be accessible. To be sure, this could be done in the journals of the various natural history societies, but this procedure would defeat one of the very objects that I have in view, that of placing my work of this description in a concentrated form, where it can be had by any one who chooses to procure it, without subscribing to the publications of half a dozen societies.

Another reason for so publishing, is that I can thus better present the subjects that I have in mind, in a form that will be understood by everyone who cares to read them. That is to say I mean to employ technical terms as little as possible, considering names merely as handles to one's ideas, which should not be made so cumbersome that they cannot be readily used. I know that many are often deterred from studying any particular branch of science, by the long array of formidable Latin or Greek names that they have to encounter at the commencement. I do not now refer to the names of objects of natural history, but to names applied to the various organizations of those objects. A simple, carefully selected, English term applied to any organ, is intelligible alike to the tyro and the advanced student.

As I have had frequent occasion to remark, science is simply a gathering together of little facts, the laying of one brick at a time, something that any one who possesses ordinary ability can accomplish; nevertheless, simple though each act may be, he who would errect any note-worthy structure that will withstand the waves of just criticism, which time will surely bring, must with care and patience, gather his facts; must with his own hands, and with precision lay each block, for even a single misplaced stone may be the cause of the fall of the whole edifice.

In these contributions, I intend to record the results of my labors in the field of scientific research. What I have seen, I shall endeavor to show to others as it has appeared to me, and herein I shall express my opinions honestly, I trust, and with freedom.



Monograph of the Genus

STROPHIA,

A Group of Tropical and Sub-tropical Land Shells.

By Charles J. Maynard.

INTRODUCTION.

Having had somewhat extended opportunities, during several collecting trips through the Florida Keys, Bahamas, and some of the West Indies, of studying the habits of the genus Strophia, I have decided to write a monograph of them. I am prompted to do this, partly because, as I have met with some twenty species living, many of which appear to be new to science, and thus know something of them, but mainly because there seems to be the utmost confusion in regard to the nomenclature of known species; insomuch so, in fact, that it becomes necessary to refer to the original description of each and every species, or to see types, before a decision can be made as to the proper name which should be applied to any given species.

Through the kindness of Prof. Alex. Agassiz, I have been allowed to examine the extensive collection at the Museum of Comparative Zoology at Cambridge, where Dr. J. W. Fewkes who has charge of the Mollusks, has given me every facility for prosecuting my researches.

Strophia has usually been regarded as a sub-genus of Pupa, but aside from the fact that I do not believe in sub-genera, I am sure that the present group is sufficiently characteristic to receive full generic rank. See further remarks upon this subject, under head of General Conclusions.

The group is an exceedingly plastic one, species becoming evolved quite readily. This is largely due to the sluggish habits of the animals; they not only remain quiescent at least six months in the year, attached to herbage or shrubbery, but judging from what I have seen of them, it is probable that individuals pass their entire lives in the area of a few square yards. A comparatively narrow strip of sand, or naked soil or rock, would be sufficient to isolate a colony, and a colony so isolated, speedily acquires specific characters. As a rule, a given species occupies a very limited area, sometimes a few square rods on a small island upon which there may be several other species. Generally species do not mingle, even if a given species be distributed throughout a section occupied by others, each will frequently be found gathered in groups, apart from the others. I have, however, found species intermingling.

Conchologists may take exception to some of my new species, thinking, perhaps, that I have used too trivial characters in separating them. Believing, however, as I do, that it is the imperative duty of naturalists today, to record minute points of differences among animals, and when these differences are sufficiently constant to indicate specific rank, to emphasize them by giving the group, so signalized, a name, I have not hesitated so to designate them, if for no other reason than for the benefit of the coming generations. As may be expected, in so recently formed species as some of the STROPHIA appear to be, there is much reversion in certain individuals toward ancestral types, producing what might at first sight be considered as intergrades, or rather the result of a union between two individuals of separate species, but among the large number of this genus that I have examined, at least 50,000 specimens, I have yet to see one which does not present characters that refer it to a given species. I have worked the vast amount of material that has come into my hands, with the greatest care, and have come to the conclusion that there are only two alternatives; either to call all of the STROPHIA one species, or to devide them as I have. Ten years ago, I might have thought the former named expedient advisable; now I think otherwise, and the species of STROPHIA given in this monograph, are the results of my studies.

C. J. M.

NEWTONVILLE, MASS., JAN., 1889.

GENUS **STROPHIA** ALBERS.

GEN. CH. Shell, varying in form from oblong-oval to cylindrical, but the width is never more than half the length and usually less, sometimes being only one third. The apex is pointed, occasionally obtusely, but the angle never measures more than 90 degrees, and when acute, it is never less than 50 degrees. The whirls vary from nine to twelve, the lower are very narrow but they rapidly become wider as they ascend, the last, with the margin of the aperture, occupying about one-half of the length of the shell. The whirls are usually furnished with prominent perpendicular striations, but are occasionally smooth. The margin of the aperture is quite prominent, produced forward so that the face is parallel with the sides of the shell, with the edges rolled backward and often thickened. Crossing the lower portion of the aperture, inclined downward to the right, is a more or less prominent frontal bar that connects the lower parts of the margin. The aperture narrows quite rapidly within, and there is a prominent tooth near the center of the lower wall and usually a second one on the column; this latter named is not always present. Young shells which are incomplete, inasmuch as the aperture is not surrounded with a margin that is produced forward, as in the adult, and which consist of fewer whirls, more or less, according to age, have as a rule, five teeth, of which two are on the upper wall, two on the lower wall, and one on the column. These teeth become absorbed as the shell grows and others take their place further in advance, hence, if they be well within the aperture, they are often less than the normal number. The spirally ascending, parietal walls are very thin, Plate II, 1c, while the wall of the hollow column, Plate II, 1c, which opens outwardly, back of the left of the aperture, is also thin. On the other hand, the outer walls which are made up of at least two layers, the outer calcareous and the inner more horny, are thick and often quite massive. In size the shells vary from .60 in length by. 25 in diameter, to 2.60 by .60, with all gradations between.

In color, outwardly the shells are usually white, often flecked or striped with purple, reddish purple, or rosy; inwardly they are either roseate or purplish of varying shades.

The animal is not large for the size of the shell, the foot, with head and eye peduncles, being about as long as the shell. The foot is slender, narrower than the aperture, about two thirds as long as the shell; beneath, it is smooth and provided with numerous pores that exude a mucous with which the animal lubricates the surface over which it glides. The foot above, in common with the entire exposed surface of the body, including the eye peduncles and tentacles, is covered with minute tubercles that are arranged in regular rows; see Plate I, 13, for head and upper surface of the body. The body is rather wider than the foot and tapers to the quite narrow head. Eye peduncles, Plate I, 13, EP, are prominent but slender and about one third as long as the shell, enlarged terminally where there is a prominent eye speck, Plate I, 13, ES. The tentacles, Plate I, 13, TT, are short, not over one third as long as the eye peduncles. Mantle, Plate I, 5, M, large, completely enfolding the body and a portion of the foot when the animal withdraws within the shell. All the figures on Plate I are greatly enlarged.

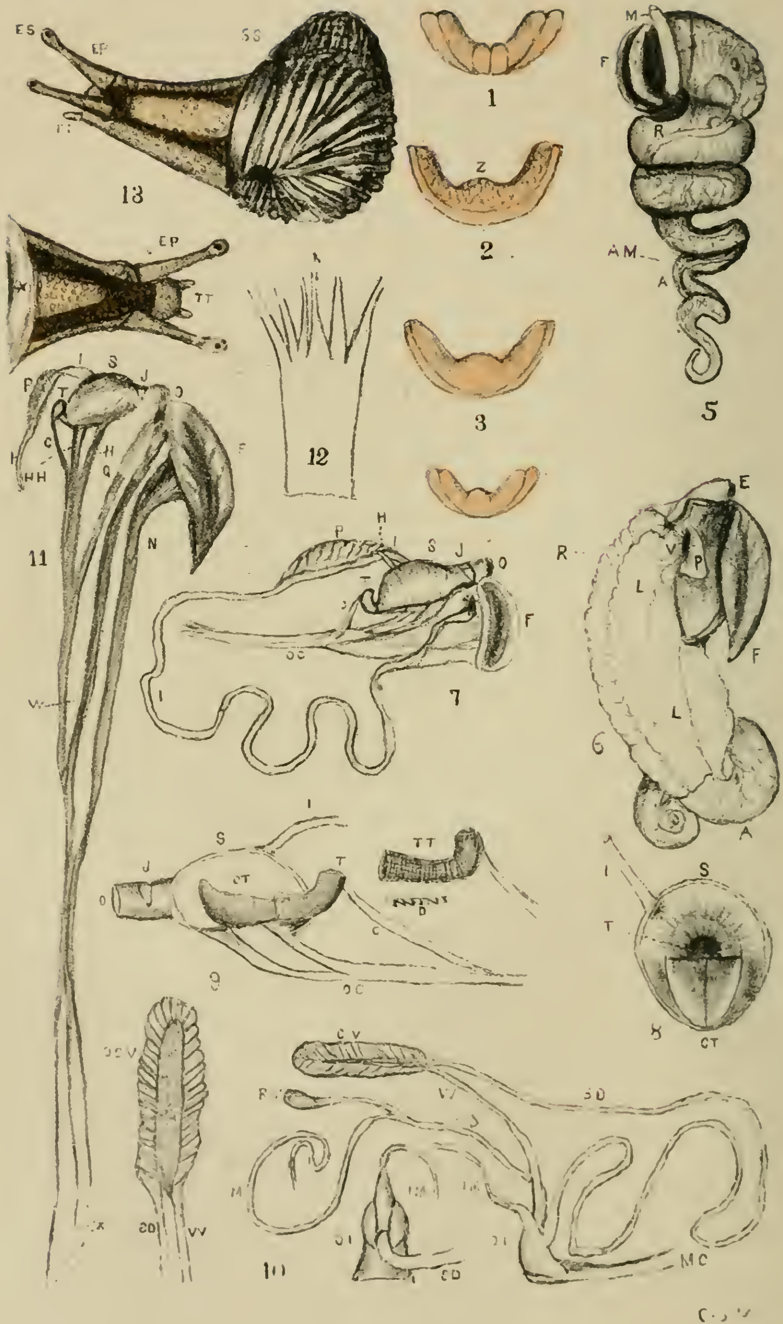
The color of the external portions is pale horn, more or less striped with black or dark brown, and occasionally the entire upper portions are so colored.

Upon removing the animal from the shell, the mantle will be found to cover the entire surface of the body, quite to the point of the elongated abdomen which occupies the interior of the lower five whirls to the tip, Plate I, 5, A, where the left side of the animal is represented. The mantle is smoother and thinner where it is not exposed than it is on the anterior portions.

The mouth opens directly beneath the tentacles, Plate I, 7, 9, 11, O; and the entrance, in the contracted animal, is a gullet capable of being protruded as far as the jaw, ib., 7, 9, 11, J. This organ is embedded in the muscles of the gullet, is crescent shaped, horny, and bright amber colored, and the horns of the crescent point downward, thus exposing the inner margin which is the cutting edge. There is considerable specific variation in the form of the jaw, and some individual, thus on Plate I, 1 & 3, I have given two jaws of different specimens of Strophia copia, 3, however, being the usual type. The jaws of all the species that I have examined, agree in certain general characters, and appear to be made up of two parts, a lower, thicker portion, which becomes sharpened into the cutting edge, in the middle of which is a kind of blunt tooth, Plate I, 2, Z, and a thinner upper portion that edges the lower and which is embedded in the muscles, 2, X, where a jaw of S. pannosa is represented. Fig. 4 shows a jaw of the smallest species of the genus known to me, S. nana, from Little Cayman. The cutting edge of the jaw is opposed by the soft, muscular, inner surface of the gullet only.

The gullet opens just behind the jaw, into a wider, egg shaped chamber, Plate I, 7, 8, 9, & 11, S. This organ which is usually called the mouth, lies on the back, and a little to the right. Externally, at the

PLATE I.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10
C.J.V.

EXPLANATION OF FIGURES ON PLATE I.

1. Unusual form of Strophia copia.

2. Jaw of Strophia pannosa; Z, blunt tooth; X, thin edge.

3. Jaw of Strophia copia, usual form.

4. Jaw of Strophia nana.

5. Left side of animal of Strophia pannosa; M, mantle; F, foot; R, rectum; AM, end of intestine; A, abdomen.

6. Right side of animal of Strophia pannosa; E, eye; P, flap to ventral opening; V, ventral opening; R, rectum; L L, lungs; F, foot.

7. Alimentary canal of Strophia copia; O, entrance to mouth; J, jaw; S, proventriculus; I, œsophagus; P, solvent glands; H, duct to same; I, termination of stomach and beginning of intestines; T, cylindrical organ of tongue; C, retractor muscle of same; OC, supporting muscle; F, foot.

8. Interior of mouth, or proventriculus; S, walls; CT, tongue; T, entrance to cylinder; I, œsophagus.

9. Side view of above; O, gullet; J, jaw; S, walls; CT, tongue: T, cylinder; TT, same detached; D, teeth of same; C, retractor muscle; oc, large muscle.

10. Reproductive organs of S. copia; OV, combined ovaries and testes; SD, spurm duct; VV, oviduct: OOV, more enlarged view of same; RV, spurm reservoir; M, accessory organ of same; OI, intromittent organ, IM, retractor muscle, and to the left, is a more enlarged view of same; mc, muscle.

11. Muscular system; N, lower muscle; W, right upper muscle; Q, left; OC, stomach muscle; H, lower branch of same; HH, upper; C, abductor muscle of cylindrical organ T; X, terminus of clinging muscles; other letters same as in No. 7.

12. Terminus of tongue muscle; X, fascicles.

13. Animal of Strophia pannosa; SS, shells; TT, tentacles; EP, eye peduncles; ES, eye specks.

back of this mouth, protrudes a cylindrical, upturned organ, ib., 7, 9, & 11, T, at the outward extremity of which, is attached a thin muscle, Plate I, 7, 9, & 11, C, that passing backward and downward obliquely, terminates on a broad, though thin, muscle, ib., 7, 9, & 11, OC. Within we find that the cylindrical projection terminates at the base of a double tongue-like muscle, the termination of which is free and projects well into the chamber, ib., 9, CT, where a side view is given, and ib., 8, CT, where a front view of this remarkable organ is represented. The edges of this tongue are turned upward, and in the contracted animal, the upper surface is turned backward, so that the tip rests against the upper wall of the mouth. Both the terminal portion of the tongue, on each surface, and the inside of the cylinder, are covered with a membrane that supports regular rows of numerous teeth which point backward, as given in ib., 9, D; TT, being the cylinder detached. As is evident, from the retractor muscle, ib., 7, 9, & 11, C, this whole arrangement is capable of being protruded forward so that the tip of the tongue will perhaps be brought in contact with the cutting edge of the jaw. The animals that I have examined, although living, had been fasting for over six months and thus not a vestage of food remained in the stomach, so it is difficult to judge whether the cylinder performed any of the labor of digestion; but in several instances, if not in all examined, this organ was filled with a kind of thick gelatinous substance: ib. 8, T, shows the entrance of the cylinder.

The œsophagus, see ib. 7, 8, 9, & 11, I, emerges from the top of the stomach, a little to the left, and turning downward and backward, passes between and below two sets of glands, ib., 7 & 11, P, the posterior portions of which are fastened by tissues to the muscle, ib., 7, 9, & 11, OC. These glands which have a granular appearance, evidently pour a solvent fluid into the mouth, or as I am inclined to regard it, the proventriculus, through the duct shown at ib., 7, II, The stomach is long and narrow, not being much larger than the intestine, and ends at the lower I, ib., 7. Beyond this point the intestine begins and enters the substance of the liver, which is of a greenish color and which occupies the terminal five whirls of the abdomen; the alimentary canal is now supplied with absorbents that terminate in a common duct which is apparent outside the liver, on the inner or spiral side. The intestine proceeds downward as far as the beginning of the fifth whirl of the body at a point about opposite ib., 5, AM. It then turns upward, emerging from the liver on the left side of the second whirl, ib., 5, R, passes around to the right of the back, where it becomes the rectum, ib., 6, R. and emerges at the vent, ib., 6, V.

The ventral orifice which is also the common opening to the lungs, is guarded by the flap, ib., 6, P, which interposes between it and the surface over which the animal may be moving with the foot extended. The lungs lie partly along the back and partly along the left side, ib., 6, L L.

The reproductive organs, as in all hermaphrodite Gasteropods with reciprocal impregnation, are quite complicated. They are situated on the right side near the ventral orifice, and are attached to one of the three large muscles, the upper right, ib., 11, W. The combined ovaries and testis, ib., 10, OV, enlarged still more at ib., OOV, lie on the upper surface of the liver, but do not penetrate it. Emerging from the upper extremity of this organ, is the sperm duct which is of a remarkable length, often three times as long as the shell; see ib., 10, SD; it is coiled on the back, beneath the lungs, and terminates on the central portion of the intromittent organ, ib., 10, OI, where there is also a greatly enlarged view of the posterior portion. This organ is retractile and the retractor muscle, ib., 10, IM, being attached to the tip and passing over the back, is inserted in the thicker portion of the mantle, near the foot on the left side. The organ when protruded, is flat but with the sides capable of being curved upward, forming a groove in the center.

The pyriform sperm reservoir, ib., 10, RV, which is a receptacle of the spermatozoa of another individual, lies against the combined ovaries and testis, its duct, ib., 10, D, enters the common orifice with the oviduct, ib., 10, VV. Midway between the reservoir and the orifice, or a little nearer the former named, a thin, cylindrical organ arises, and passing downward along the liver, terminates in a blind, sometimes slightly enlarged, end in the three last whirls of the abdomen; see ib., 10, M. Special mention of this organ will be made under the head of General Conclusions.

The principal muscular system may be briefly described as follows: The stomach is provided with a broad, flat muscle, which is divided into two branches, ib., 11, H, and HH, the latter named of which supports the tongue, and terminates in six fascicles ,ib.. 12, FF. This stomachic muscle is inserted on one of the two upper foot muscles, the left, ib., 11, Q; this, with its fellow, ib., 11, W, on the right. have a common origin; below them is another, ib., 11, N. All these three muscles are broad, the edges only being given in the figures, but as they pass downward they become rapidly narrower and are finally reduced to mere threads. These passing around on the inside of the liver cling to the column, and thus enable the animal to retain a given position in the shell, for it has no direct attachment to the shell. The eye peduncles and tentacles are drawn inward by a muscle attached near the termination on the inside, as is usual with members of this family. For further special anatomical structure see Specific Characters under head of individual species, and in General Conclusions.

GENERAL HABITS.

All of the species of Strophia that I have seen living are gregarious, hundreds often occurring within a few square inches, frequently clinging together, one top of the other, sometimes three or four deep. When thus found, they are hybernating, or if in the tropics, passing the dry season in a state of inactivity, and as a rule, whenever rain falls, even although it be for a short period, they immediately begin to move. They are herbivorous, and even when inactive, remain upon the plants or shrubs on which they feed, or near them, rarely retreating beneath stones.

It is probable that the eggs are laid upon the branches of shrubs, or other similar situations, although at present I can state nothing definite regarding their breeding habits. I have never seen any very young shells of this genus, the smallest consisting of four or five whirls.

When an animal of Strophia wishes to retreat within its shell for any purpose, it withdraws itself well within the aperture, by this act, partly doubling the foot; from this doubled foot and the mouth, exude a clear, thick, glairy fluid that soon hardens when exposed to the air. By muscular contractions, the foot or surface of it, that comes in contact with the now hardening film, is undulated, thus separating it from the completely hardened and transparent wall. The foot is now withdrawn, then follows the remainder of the body, the ventral orifice, Plate I, fig. 6 v, being the last to be taken away. This occupies the lower right hand corner of the aperture and leaves a small hole. The animal now disappears, retreating as far back as the third whirl, but at about .25 from its final resting place, a second partition, (Plate II, 1, c, where the white partition may be seen in the second whirl,) is formed; the first wall is straight and, as remarked, transparent; the second is curved downward on the outer side and is nearly as opaque as rice paper which it resembles. Both walls are readily soluble in water, so that these would form no protection in case the animal fell into the water, for being air breathing, it would soon perish. The time occupied in constructing the first wall, is about three minutes. Occasionally a third wall is constructed, it being the object, evidently, of the animal to retreat within the shell as far as possible, where it remains when alarmed or during the period of hybernation.

GENERAL DISTRIBUTION.

The species of the genus Strophia appear to be centralized in the Bahamas, Cuba and adjacent islands; from these localities they are distributed outwardly in several directions. but sparingly and somewhat irregularly; thus although there are several in Hayti, there are none as far as known, in Jamaica. They are found on Porto Rico, but there are none on the Windward Islands, with the exception of a single species on Curacoa, south of Guadaloupe. One species only, as far as described, is to be found on the continent of North America, S. incana, which occurs abundantly at Key West, and possibly on some of the other keys and on the mainland. I have reasons for believing, however, that one or two other species occur on the Keys and on the extreme southern mainland of Florida. In South America, but a single species is known, S. antonio from Berbice. Thus it would appear that Strophia is almost exclusively an insular genus and I have never found them occurring far from the sea, even on small islands.

SPECIFIC CHARACTERS.

In deciding specific rank I have used the following characters, all of which are of vital importance to the life of the animals, one or another becoming more prominent under various existing circumstances: Form of shell; size; color, external and internal, whether exhibiting general tintings or markings; absence or presence of striations, their number size and regularity of form; thickness and width of margin; position and form of aperture; number of teeth, their size, length and relative position in aperture; form and size of animal and of the various internal organs when known.

Before deciding as to what characters could be made available in indicating specfic rank, I have have endeavored to thoroughly understand the range of individual variation, and to accomplish this, I have often examined with care, thousands of some species. Individual differences vary in number and kind with species, sometimes these are very great, often affecting characters that in other species remain unchanged. As will be seen, however, under head of Observations, one or more characters will be found sufficiently constant to render the species in hand recognizable. Owing to the results produced by the operations of the mysterious laws of evolution, species placed under similar conditions, even although occurring in widely divided islands, are similar, yet, although it will not be impossible for one species to occur in widely separated islands, I have never seen such a species, as I have always found some character possessed by one not found in the other.

As would naturally be expected in so plastic a genus, indications of the probable appearance of species very frequently occur. In such groups there is often strong inclination to assume certain characters, but on account of frequent gradation, through both reversion and direct hybridization, no absolutely fixed characters can be found. As all gradations occur between a group that might, at first sight, appear strongly marked enough to be considered as a sub-species, and what is most undeniably individual variation, I have not ventured to name these groups, not knowing where to draw the line, but I have always mentioned them, stating their peculiarities, The differences which now render these forms conspicuous, may increase and form a species with the individual characters prominent, or the form may revert to the original species and so become absorbed, or again, it may assume under some changing circumstances, totally different characters, acquiring a final specific form, utterly at variance from what now appears probable.

For remarks on origin of the genus, evolution of species, and relationship to allied genera, see General Conclusions.

DESCRIPTION OF SPECIES.

I. STROPHIA PANNOSA Novo.

Ragged Strophia.

Plate I, 13, animal; ib., 2, jaw.
Plate II, 1 & 1B, shell; 1C, section; 1D, young.

DESCRIPTION.

SP. CH. Size, large. Shell, robust and heavy. Strations, present but coarse. Tentacles, short, about one fifth as long as eye peduncles; teeth, two, both very long. Whirls, 12. Examined 400 specimens.

Form of shell, long oval, that is, the greatest diameter is through the second whirl; the first and third being a little smaller. Each whirl below is successively .05 smaller than the one above it, thus tapering to a blunt point, and forming an angle cf about .60 degrees. There are 18 coarse, widely separated, irregularly formed striations, some of which are omitted, making the interspaces even wider. The striations are not arranged in continuous rows, and are inclined from right to left. The sutures between the whirls are not deep.

Aperture, small, contracting rapidly within, where there are two, very prominent, long teeth, the lower of which extends backward into the shell .26, and is about .05 high, while the upper makes a complete turn around the column. The position of the lower tooth is about central and the upper is elevated just above it.

The margin is not produced forward beyond the diameter of the shell but is greatly thickened, with the outer posterior portion provided with a thin, though not very prominent edge. The frontal bar is well developed, completely interrupting the striations; thus the lower wall of the aperture is smooth. Animal, large; eye peduncles, .25 long; jaw, with lower portion covered with tubercles.

Color of shell externally, white, with the apex pale purplish brown: internally, pale purplish brown, but this color does not extend beyond the teeth, fading gradually as it approaches them, so that both they and the walls beyond them are flesh color. Color of animal, pale brown, with a V-shaped mark of dark brown on the back; see Plate I, 13, upper and lower figures.

DIMENSIONS.

Size of types, 1.27 by. 57 and 1.23 by .50. Largest specimen, 1.27 by .58; smallest, 1.00 by .48. Greatest diameter, .58; smallest, 47. Longest specimen, 1.47; shortest, 1.00.

OBSERVATIONS.

There is some variation in form as well as in size, some individuals exhibiting a tendency to become shorter and proportionately wider than the type, but this character in uninjured and perfectly adult specimens is not very marked; on the other hand, at one point within the range of the species, I found a colony having nearly parallel sides; that is the three first whirls are nearly equal in diameter, and the margin is not as thick as that of the type, measuring only .08, the type being .12; an approach to this form is figured on Plate II, 1B. In color, the species is quite uniform; some are slightly flecked wlth brown, but this is rare, and they are oftener white to the apex. The striations are most numerous and most regular in the cylindrical form. They vary in number from 17 to 24 on the first whirl. The whirls vary from 10 to 12.

Known from all others by the large size, elongated teeth, irregular, widely separated, coarse striations, thickened margin, and white color.

DISTRIBUTION AND HABITS.

The Ragged Strophia occurs on the west end of the island of Little Cayman, living on the coarse vegetation which grows among the rocks that lie just above the beach. I have never found them east of the little cove, on the north side, called Bloody Bay, where the rocks of what is known as the Iron Shore terminate, nor east of the few houses which constitute the only settlement on the key, on the south side; thus they occupy a line, somewhat broken, of a few yards in width and about three miles long. This narrow strip was occupied by them almost exclusively, insomuch so that out of three hundred Strophias that I gathered in a two mile walk, twelve only were of another species, (S. levigata).

In habit they differ from many of the species occurring on the Caymans, in being rather solitary, at best only a dozen or so being found together, consequently they were not abundant. At the time of my visit the last week in April, the weather was mainly dry, and they were clinging to the low, stunted plants, or to rocks, and not feeding. Upon examining the basket, in which I had placed some during the day, late in the evening, I found them crawling actively, and upon being brought north, they were occasionally active until cold weather, when they all died, but for at least six months they lived entirely without food of any description.

2. STROPHIA LEVIGATA Novo.

Smooth Strophia.

Plate II, 2 & 2B, shell.

DESCRIPTION.

Sp. Ch. Size, large. Shell, robust and heavy. Striations, absent. Tentacles, about one fifth as long as eye peduncles. Teeth, two, and very long. Whirls, 11. Examined 150 specimens.

Form of shell, inclined to cylindrical, the first and second whirls being equal in diameter, and the third is but little smaller, and from this the shell tapers to quite an acute point, making an angle of .55 degrees. The striations are represented only by faintly defined lines of growth, that are, however, more prominent on the upper whirl, especially on the right side near the aperture, where there are some prominences, but these prominences are widely separated and irregular.

The aperture is small and contracts rapidly within, and the teeth are long and prominent; the central which is placed midway between the two walls, is .25 long, and the upper which is placed slightly above it, makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, but is greatly thickened, and the outer posterior portion is provided with a thin, though not very prominent, edge. The frontal bar is prominent and interrupts the striations, thus the lower wall of the aperture is smooth. Jaw, as in S. pannosa, and the animal is similar in form, but paler in color above.

Color of shell, externally, white, slightly flesh colored at extreme tip of apex; internally, pale purplish brown, but this color does not extend beyond the teeth, but fades gradually as it approaches them, so that both they and the walls beyond them are yellowish brown.

DIMENSIONS.

Size of types, 1.25 by .52 and 1.15 by .48. Largest specimen, 1.34 by .55; smallest, 1.06 by .47. Greatest diameter, .55; smallest, .46. Longest specimen, 1.34; shortest, 1.06.

OBSERVATIONS.

The cylindrical form prevails, but there is a tendency among some shells to assume a more pointed apex, and in these cases the third whirl is much smaller than the one above it, and in some instances the upper whirl is the largest. The color is nearly always uniform white, but in some specimens there is a tinging, not a flecking, of fleshy or pinkish, due to a thinning of the outer covering, evidently the result of abrasion.

The few prominences of growth that have any claim to be considered striations, are confined to the upper portion of the first whirl, usually near the aperture, but in some instances, they extend around to the left, to a point nearly opposite the margin, but in no case do they extend past this point. These are evidently reversions toward the striated form, which is probably the original species on the key, as the majority of the species here are provided with striations.

Known from all other species by the large size, absence of striations, pointed apex, long teeth, white color, and thickened margin.

DISTRIBUTION AND HABITS.

This species occurs on the west end of Little Cayman, very sparingly on the coast, and rather more commonly among the low growth of trees in the interior. They occupy an extent of country, about three miles long by a mile in width.

The habits of the Smooth Strophias are even more solitary than those of the Ragged Strophias, as they occur in isolated groups of four or five individuals, and these groups are scattered at rather wide intervals along the only two paths that cross the key anywhere; these start together on the south side but emerge about a mile apart, on the north side, near the west end. They may have occurred elsewhere in the interior, but the almost impassable character of the thick jungle, and the rough ground from which it springs, render traveling very difficult, often impossible without cutting away the shrubbery.

3. STROPHIA INTERMEDIA Novo.

Small Rough Strophia.

Plate II, 3 & 3B, shell.

DESCRIPTION.

Sp. Ch. Size, rather small. Shell, quite thin and not very robust. Striations, present and coarse. Tentacles, not very short, about one third as long as the eye peduncles. Examined 3,000 specimens.

Form of shell, short oval, the greatest diameter being on the second whirl, the first and third being very little smaller, and from this the shell tapers to a rather blunt point at the apex, forming an angle of about 60 degrees. There are 16 coarse, widely separated striations, some of which are omitted, and none of which form regular lines, but are somewhat inclined from right to left. The striations are wide, measuring .03, and are generally furrowed longitudinally on top, but the edges are rounded. The sutures between the whirls are not very deep.

Aperture, rather small, but not contracted within. The central tooth is prominent and long, extending back into the shell .18, and its position is central; the upper tooth is placed just above it, and although it is not prominent, is long, and takes a turn around the column.

The margin is not produced forward quite as far as the diameter of the shell; it is not greatly thickened, measuring .06, and the posterior portion is produced backward into a thin, though not prominent edge. The frontal bar is moderately developed, and the striations are interrupted, not appearing within it. The striations on the back of the shell may be seen within the aperture, when held against the light. The animal is not very large; eye peduncles, .15 long; tentacles, .05; jaw, as in S. copia.

Color, white, with an occasional spot of purplish between the striations, and with the apex flesh color; internally, purplish brown which fades as it approaches the teeth, and does not extend beyond them; thus both they and the portions beyond them are pale flesh color. Color of animal, pale brown, with a V-shaped mark on the back, of the same color but somewhat darker.

DIMENSIONS.

Sizes of types, .90 by .40 and .88 by .40. Largest specimen, 1.04 by .44. smallest, .82 by .40. Greatest diameter, .47; smallest, .38. Longest specimen, 1.04; shortest, .82.

OBSERVATIONS.

Although the great majority of specimens of this species, are constant to the type, yet variation is very great, some specimens before me ranging from cylindrical, with the three first whirls of the same size, to those that are nearly top-shaped, having the first whirl the largest, with all gradation between. The margin varies in thickness, .12 being the extreme width. In color the tendency is to become whiter than the type, with no spottings and no fleshy tintings on the apex. The whirls are almost invariably ten but are rarely eleven. The striations vary from 16 to 19, but in all of this variation, the only decided form, is one that lives on stunted vegetation which is found in exposed situations on rocks; these are white with aheavy shell, through which the striations cannot be seen when held to the light. Some shells are not long but quite thick in diameter when compared with the type.

The Small Rough Strophia is found on the low vegetation that grows on the margin of the beach on the south side of Little Cayman, The top-shaped form mentioned is very rare and is probably the results of an injury that the animal received, causing it to form a margin to the shell when it was not fully grown.

Distinguished from S. pannosa by the smaller size, thinner shell and margin, and more open aperture; from copia, which it resembles in size, by the smaller number of striations, 16 to 19 instead of 22 or more. The interspaces in this species are wider than the elevated striations, while in copia the reverse is the case.

Known from all other species by the rather small size, elongated teeth, irregular, widely separated, coarse striations, and white color.

DISTRIBUTION AND HABITS.

The Small Rough Strophia is found on the coast of the south side of Little Cayman, west of a large mangrove swamp that nearly divides the island into two unequal portions, and along the beach on the south side of Cayman Brac, as far east as the cocoa-nut grove extends, now about half the length of the key.

They are much more common than the Ragged Strophia, and although they mingle occasionally with the colonies of the Common Strophia that border the shore, they are never found far from the beaches. They are more common on Little Cayman than on Cayman Brac; see further remarks under habits of S. copia.

4. STROPHIA ACUTA Novo.

Pointed Strophia.

Plate II, 4 & 4B, shell.

DESCRIPTION.

Sp. Ch. Size, rather small. Shell, moderately heavy. Striations, absent. Tentacles, not very short, about one third as long as the eye peduncles. Examined 500 specimens.

Form of shell, pointed oval, the greatest diameter being at the suture between the first and second whirls, and each whirl below the second is successively .05 smaller than the one above it, and thus the shell tapers quite rapidly to the apex, forming an angle of about 46 degrees. There are only faintly defined lines of growth, that assume but little prominence even on the upper whirl; hence the shell is very smooth, and even the sutures between the whirls are very shallow.

The aperture is small but rather open, the internal diameter, just inside the margin, being a trifle more than at the entrance. The lower tooth measures .18 in length by .05 high, is placed a little to the right of the center, and the upper placed slightly above it, is long, making a complete turn around the column, but is not very prominent.

The margin is not produced forward quite as far as the diameter of the shell and is slightly inclined backward at the top; it is not greatly thickened, measuring .05, and the posterior portion is produced back into a rather blunt and not prominent edge. The frontal bar is well developed. An interesting series of immature specimens of this species not only show that the shell is greatly thickened after it becomes nearly, or quite, fully grown, but also show that the frontal bar is not formed until the margin is completed. The animal is not very large; eye peduncles, .15 long; tentacles, .05.

Color, white, slightly tinged with purplish or bluish; internally, purplish brown which becomes paler on the lower wall of the aperture, and fades on the upper walls and teeth, into flesh color. Color of animal, very pale brown, with the back wholly brown of a darker shade.

DIMENSIONS.

Size of types, .94 by .40 and .94 by .38. Largest specimen, 1.07 by .45; smallest, .80 by .33. Greatest diameter, .45; smallest, .33. Longest specimen, 1.07; shortest, .80.

OBSERVATIONS.

The type described is constant in a very large percentage of specimens, the chief variation being in size, and this, excepting in the smallest specimen given which is an isolated example, and may even prove a distinct species, is not great. Two different forms appear; one, cylindrical and proportionately slender, having the first three whirls of the same diameter, and with the aperture inclined considerably to the right, and one wherein the form is proportionately thicker than the type, with the sutures very deep. The color is uniform, some pinkish tipping appearing which is, however, due to abrasion.

Known from all others, by the pointed apex, small size, absence of striations, long teeth, and white color.

DISTRIBUTION AND HABITS.

Under Habits and Distribution in the preceding species, I have spoken of two paths that crossed the island of Little Cayman, and these two ways formed a junction a few hundred yards from the south shore. Near this junction, the western most crossed a small open patch of ground, the borders of which were surrounded with quite low bushes. The bushes that grew on the south side of this little natural clearing, were the stronghold of the Pointed Strophias, and I did not find them elsewhere. The border line to the north, was sharply defined at the clearing, but south, they straggled out along the higher bushes for some few hundred feet, but the entire space occupied by them, did not exceed a quarter of an acre in extent.

In habit, the Pointed Strophia is highly gregarious, hundreds occurring together in a few square yards. They appear to feed upon the foliage of the bushes, on which they were clinging, a small leaved shrub which I did not, however, find in bloom, so cannot tell to what family it belongs.

5. STROPHIA FESTIVA Novo.

Pictured Strophia.

Plate II, 5 & 5B, shell: 5C, young.

DESCRIPTION.

Sp. Ch. Size, large. Shell, robust and heavy. Striations, absent. Tentacles, short, about one third as long as eye peduncles. Teeth, two, both very long. Whirls, 11. Examined 22 specimens.

Form of shell, inclined to cylindrical, the first and second whirls being equal in diameter, and the third is but little smaller, and from this the shell tapers to quite an acute point, making an angle of .55 degrees. There are only faintly defined lines of growth which, however, assume more prominence on the back of the upper whirl, but these prominences are widely separated and irregular. The sutures between the whirls are not deep.

Aperture, rather small, but open, the diameter of the cavity slightly increasing just within the entrance; the teeth are prominent, the lower, which is placed midway between the two walls, is .25 long and about .05 high, and the upper which is situated just above it, measures only .03, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, and is not greatly thickened, measuring .08, and the outer posterior portion is provided with a thin, quite prominent, edge. The frontal bar is not very prominent.

Color of shell, externally, bluish white, marked with longitudinal spots of purplish brown, that from the third whirl downward exhibit a tendency to become fused together and form rings near the middle of the whirls. The spottings are somewhat interrupted, and are fewer on the upper, and more numerous on the lower whirls. The frontal bar, teeth, and margin, externally and internally, are flesh color of quite a dark shade, but within the aperture this color gradually deepens into purplish brown, which pervades the whole interior.

DIMENSIONS.

Size of types, 1.20 by .50 and 1.18 by .48. Largest specimen, 1.24 by .54; smallest, .95 by .46. Greatest diameter, .54; smallest, .46. Longest specimen, 1.24; shortest, .56.

OBSERVATIONS.

The typical form given prevails but there is a tendency to a more pointed apex, with the second whirl smaller than the first; this form is figured on Plate II, 5. The margin of some specimens is very much thickened, the extreme measuring .13. In color, there is some variation in markings; although in two instances the spottings are more restricted than the type, in the majority of cases they are more extended, and in two shells the purplish brown predominates. The tendency to assume rings on the lower whirls is quite prominent, and is an unusual feature in Strophia.

Known from all others by the large size, absence of striations long teeth and purplish markings.

DISTRIBUTION AND HABITS.

On the western path that crossed the island of Little Cayman, of which I have spoken in my account of the preceding species, about midway between the two shores, or a little nearer the northern, being thus a short half mile from the sea, were two small fields, or cultivated patches of land, containing, perhaps, a quarter of an acre each. In these limited areas I found the few specimens of the Pictured Strophias that I was able to obtain.

In habit these Strophias are one of the most solitary species that I have ever seen living, for they occur in very scattering groups on the low herbage that margins the fields; and thus limited, were not common.

6. STROPHIA PICTA Novo.

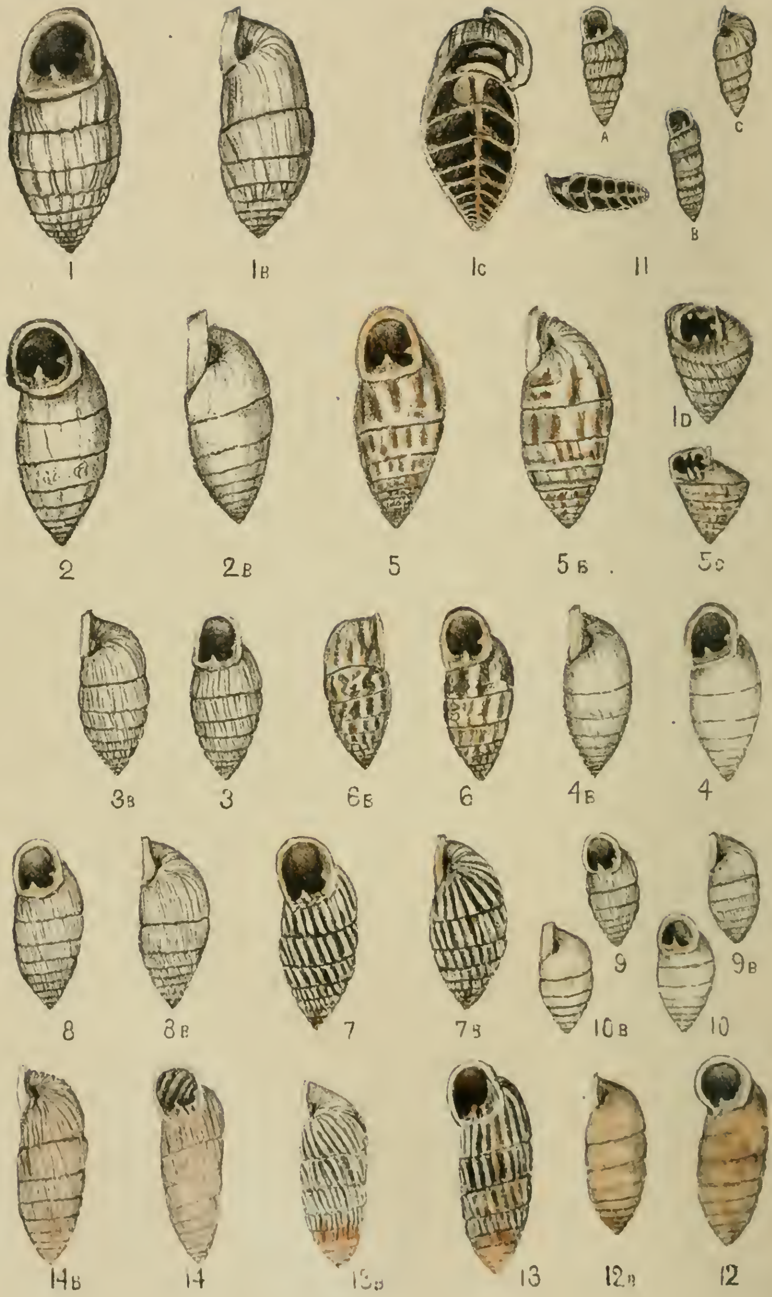
Painted Strophia.

Plate II, 6 & 6B, shell.

DESCRIPTION.

SP. CH. Size, small. Striations, absent. Whirls, 10. Teeth, two, and quite long. Examined 75 specimens. Tentacles, short.

PLATE II.


1
1B
1C
11
A
B
C
2
2B
5
5B
5C
1D
3B
3
6B
6
4B
4
8
8B
7
7B
9
9B
10B
10
14B
14
13B
13
12B
12

EXPLANATION OF FIGURES ON PLATE II.

1. Strophia pannosa, front view of type shell; 1B, left side of another individual; 1C, section and 1D, young of same species.

2. Strophia levigata, front view of type shell; 2B, left side of another individual.

3. Strophia intermedia, front view of type shell; 2B, left side of another individual.

4. Strophia acuta, front view of type shell; 4B, left side of another individual.

5. Strophia festiva, front view of type shell; 5B, left side of another individual; 5C, young of same species.

6. Strophia picta, front view of type shell; 6B, right side of another individual.

7. Strophia lineota, front view of type shell; 7B, left side of another individual.

8. Strophia copia, front view of type shell; 8B, left side of another individual.

9. Strophia parva, front view of type shell; 9B, left side of another individual.

10. Strophia glaber, front view of type shell; 10B, left side of another individual.

11. Strophia nana, A, front view of type shell; B, left side of another individual; C, front view of another form; D, section of same species.

12. Strophia nuda, front view of type shell; 12B, left side of another individual.

13. Strophia ianthina, front view of type shell; 13B, left side of another individual,

14. Strophia palida, front view of type shell: 14B, left side of another individual.

Form of shell, a pointed oval, with the second whirl the largest; the first and third are about the same size and from the third, the shell tapers to quite a blunt point, forming an angle of about 60 degrees. The lines of growth are very faintly defined, and become prominent only on the top of the first whirl. These prominences begin on a line with the frontal bar, and end at a point about half way up the margin, on the right, thus occupying the top of the whirl, ending abruptly on the line drawn, the shell below this being smooth. Sutures, not deep.

Aperture, rather small, but open, and the diameter of the cavity just within is a trifle more than at the entrance. Lower tooth, about central in position, and is .18 long by .05 high; the upper is situated just above it, is only .03 high, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, it is not very thick, measuring only .08, and is provided on the outer posterior portion with a rather blunt edge which unlike the majority of species, is not rolled backward. The frontal bar is not very well developed, and the lines of growth appear within it.

Color of shell externally, bluish white, marked with rather zig zag longitudinal spottings of purplish brown, that are more numerous on the lower whirls. The margin, externally and internally, and the teeth are yellowish, but this color gradually deepens within to a purplish brown, which color pervades the lower wall and whole interior.

DIMENSIONS.

Sizes of types, .96 by .40 and .86 by .39. Largest specimen, 1.04 by .41. smallest, .83 by .36. Greatest diameter, .46; smallest, .36. Longest specimen, 1.04; shortest, .83.

OBSERVATIONS.

The type is very constant and the principal departure from it, is a form that is proportionately longer and more cylindrical, but tapering from the second whirl to the apex. Individuals are shorter and with a larger diameter than the types, but scarcely constitute even a group. In color the inclination is to be redder in markings, than the types, and although a few show broader stripes, the tendency is to exhibit norrower ones, with broader areas of white. The margin is never very heavy, .10 being the extreme measurement, and the fact that the outer posterior portion is not rolled backward, is a marked feature and quite constant. The restriction of the prominent lines of growth, to the top of the first whirl is a usual, though not absolutely, constant character, it being extended in some specimens, to the lower part of the whirl, but does not extend very far back.

Known from S. festiva, its nearest ally, by the small size, more regular markings, and thinner margin, and from all others, by the absence of striations, long teeth, and purplish markings.

DISTRIBUTIONS AND HABITS.

This species occurs in a very limited area, on the west end of Little Cayman. Near the southern termination of the western path that extended across the key, or rather near its junction with the main path, was a patch of guinea-grass; in this, were numerous open spots, and in them, or on their borders, these Strophias lived, occupying in all about a half acre.

The habits of the Painted Strophias are rather more social than those of the Pictured, as they occur in small groups of a half dozen or more, but are nowhere common.

7. STROPHIA LINEOTA Novo.

Lined Strophia.

Plate II, 7 & 7B, shell.

DESCRIPTION.

Sp. Ch. The size is medium. The shell is rather heavy. The striations are present. Tentacles, about one third as long as the eye peduncles, Teeth, two and quite long. Whirls, 10. Examined 1,000 specimens.

Form of shell, cylindrical, with the first three whirls equal in diameter. From the third whirl, the shell slopes rapidly to a point, making an angle of 65 degrees. The striations are rather numerous, 20 on the upper whirl, prominent, regular, although not arranged in lines; they are slightly inclined from right to left, and the interspaces are about equal in width to the prominences. The striations are not furrowed and the edges are smooth and rounded.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .04 high by .18 long, and its position is about its width to the right of the center; the upper is not as prominent, is placed considerably above it, .05, and measures .02, but makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, but is inclined slightly to the right, beyond the side; it is not greatly thickened, measuring .04, but the outer posterior portion is produced backward into a thin, but not prominent, edge that is rolled slightly downward. The frontal bar is not well developed, and the striations appear within it, but beneath the translucent enamelling of the lower wall, and are thus not elevated. The animal is not very large; eye peduncles, .12 long; tentacles, .04.

Color of shell externally, white, with mest of the interspaces between the striations, dull purplish brown; internally, of rather a pale purplish brown which becomes paler on the lower wall of the aperture, and fades on the upper walls and teeth, into yellowish white. Color of animal, very dark brown, with the bottom of foot, eye peduncles, tentacles, and top of head in front of tentacles, horn color.

DIMENSIONS.

Size of types, 1.04 by .40 and .98 by .42. Largest specimen, 1.10 by .46; smallest, .74 by .36. Greatest diameter, .46; smallest, .36. Longest specimen, 1.10; shortest, .74.

OBSERVATIONS.

Individual variation is not great, the type form being very constant. Two forms occur besides, one of about the same ferm, but with the aperture inclined well to the right, and the shell is larger, thicker, and whiter, with fewer markings; while the other is shorter and proportionally a little thicker, with the markings in some instances, extending across the striations. The margin is never heavy, .08 being the extreme measurement. Striations vary from 18 to 20.

Known from S. copia, its nearest ally, by the prominent markings, and from all others, by these and the long teeth.

DISTRIBUTION AND HABITS.

I found the Lined Strophia in a small cocoa-nut grove on the south side of Little Cayman, near the east end, and more rarely in the cocoanut grove near the boat landing, on the south side of Cayman Brac, This spot on Little Cayman, about a half acre, was occupied by them exclusively, while on the other key, they mingled with the Common Strophias. They were probably transported from one place to the other by boat, the original locality, probably, being Little Cayman.

The cocoa-nut grove where I found these Strophias, was situated directly on the shore, some miles from any settlement, and was completely isolated from all other colonies of Strophias. The width of the key intervened between this point and a colony of S. copia on the north shore, two miles, at least, of nearly naked, jagged rocks, as impassable to a mollusk of this species, as would be the wide Atlantic, and there was no vegetation in this direction, to induce them to extend their colony, and between them and the several species that occupied the west end of the island were miles of rocky country and the mangrove swamp. I found them very abundant, clinging to the fallen cocoa-nut leaves and other debris that lay upon the ground. They were gathered in close clusters of many individuals, often one top of another.

8. STROPHIA COPIA Novo.

Common Strophia.

Plate I, 1 & 3, jaw; 7, 8, 9, 10, 11, & 12, structure.
Plate II, 8 & 8B, shell.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, rather heavy. Striations, present. Tentacles, about one third as long as eye peduncles. Teeth, two and quite long. Whirls, 10. Examined 10,000 specimens.

Form of shell, cylindrical, with the first three whirls about equal in diameter. From the third whirl, the shell slopes rapidly to a point, making an angle of 65 degrees. The striations are rather numerous, 23 on the upper whirl, prominent, and regular, although not arranged in lines; they are slightly inclined from right to left, and the interspaces are about one third as wide as the prominences. The striations are very slightly furrowed on the top, and the edges are quite smooth and rounded.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .05 high by .20 long, and its position is a little more than its width to the right of the center; the upper is not as prominent, is placed considerably above it, .05, and measures .02, but makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, but is inclined slightly to the right, beyond the side; it is not greatly thickened, measuring .06, but the outer posterior portion is produced backward into a thin, but not prominent, edge that is rolled slightly downward. The frontal bar is quite prominent and interrupts the striations. Animal, not large; jaw, smooth.

Color of shell, externally, white. The frontal bar, teeth, and margin, externally and internally, are flesh color, but within the aperture this color gradually deepens into purplish brown, which pervades the whole interior. Color of animal, horn, with a V-shaped mark of brown on the back.

DIMENSIONS.

Size of types, .90 by .40 and .95 by .40. Largest specimen, 1.07 by .45; smallest, .75 by .32. Greatest diameter, .45; smallest, .46. Longest specimen, 1.07; shortest, .75.

OBSERVATIONS.

Among the large amount of shells that have passed through my hands, the typical form prevails, but there are, at least, four distinct forms in which certain characters are quite constant, but there is by far too large a percentage of gradation between them and the types, to admit giving them a name, excepting, perhaps in one instance. The first form that I shall mention, is of small size, the smallest dimensions given, but the proportions are the same, however, as the types; next comes one that is more cylindrical than the types, the third whirl being but little smaller than the those above it, and it is proportionately more slender; then we have a shorter and proportionately much thicker form in which the width is but a trifle less than one half the length; in these three forms, the whirls are 10. The fourth form is one that has occasioned me some perplexity; it is large, the largest size given, the shell is quite thick and heavy, the aperture is inclined somewhat to the right, and above all, the whirls are 11. Could I have been sure that this shell gathered in localities of its own, apart from others, I should consider that it possessed important characters enough to entitle it to a name, but I cannot remember that I found it separate anywhere, nor did I make any notes on it. In color of S. copia, there is a slight inclination to a brownish flecking.

Known from all others by the numerous striations, 22 or more, size, .75 or more long, 10 or 11 whirls, absence of any decided markings, and long teeth.

DISTRIBUTION AND HABITS.

The Common Strophia occurs on the west end of the island of Cayman Brac, and at a fishing camp on the north side of Little Cayman, also scatteringly about the houses on the west end of this key, but was probably carried to the two latter named places, by the inhabitants, the animals crawling upon their boats, or lumber, etc., and were in this manner transported.

I do not remember ever having seen any species of Land Shell, more abundant this species of Strophia. In the shrubbery that bordered the paths and roads about the west end of Cayman Brac, they were very common, clinging to the base of the bushes, in masses, but their stronghold was the cocoa-nut grove on the south shore of the key, just opposite the few houses at the west end; here they absolutely swarmed in certain spots. Not only was the low herbage covered with them, but they fairly whitened the bases of the stems of the cocoa-nut trees, and often accumulated in such numbers on the small stumps, that they clung one top of another, often three or four deep, and could be gathered by the double handfuls. As the weather was mostly dry, they did not move much, so I could not decide upon what plant they fed, but judging from their numbers, this food plant must have been abundant, and by cultivation of the soil, the Strophias were placed under favorable circumstances for the increase of the species. Through the agency of man, three or four other species had been introduced into this large colony which occupied in all, about half a square mile of country.

9. STROPHIA PARVA Novo.

Little Strophia.

Plate II, 9 & 9B, shell.

DESCRIPTION.

SP. CH. Size, very small. Striations, present. Teeth, two, and rather long. Whirls, 9. Tentacles, quite short. Examined about 1,000 specimens.

Form of shell, nearly oval, with the second whirl the largest; the first and third are a trifle smaller and about the same size, from the third the shell tapers to quite a blunt point, forming an angle of about 60 degrees. The striations are 18 on the first whirl, are quite prominent, slightly furrowed, but with the edges rounded; the interspaces are narrower than the prominences. Sutures, rather deep.

Aperture, not very small, but open, and the diameter of the cavity just within is a trifle more than at the entrance. Lower tooth, placed a little to the right of the center, and is .16 long by .05 high; the upper is situated just above it, is only .02 high, but makes a complete turn around the column.

The margin is not produced forward quite as far as the diameter of the shell, it is not thick, measuring only .06, and is provided on the outer posterior portion with a rather blunt edge which is slightly rolled backward. The frontal bar is quite well developed, and the striations do not appear within it.

Color of shell externally, dull white, with an occasional patch of purplish yellow which is due to a wearing away of the outer surface through abrasion. The margin, externally and internally, and the teeth are yellowish, but this color gradually deepens within to a purplish yellow which color pervades the whole interior.

DIMENSIONS.

Sizes of types, .60 by .30 and .63 by .32. Largest specimen, .72 by .32; smallest, .60 by .30. Greatest diameter, .37; smallest, .27. Longest specimen, .72; shortest, .68.

OBSERVATIONS.

The type is very constant and the principal departure from it, is a form that is proportionately longer and more cylindrical, but tapering from the second whirl to the apex. Individuals are shorter and with a larger diameter than the types, with from 20 to 24 whirls and may constitute a group. In color there is an inclination to show fleckings and to increase the worn patches. The margin, as a rule, is not heavy, but now and then this is thickened, .10 being the extreme.

Known from all other species, by the presence of striations, small size, less than .73 long, and long teeth.

DISTRIBUTION AND HABITS.

This species occurs in a very limited area, on the west end of Cayman Brac. Near the northern termination of a path that crosses the key near the western end, is a strip of quite high shrubbery, and in this these Strophias lived. From this point, they were scattered at intervals, quite into the large colony of Common Strophias, in the cocoa-nut grove on the south side, having evidently been inadvertently transported by the inhabitants.

In habit these Strophias are decidedly social occurring in groups of a dozen or more, clinging to the branches of the shrubbery, often at a considerable distance from the ground, sometimes five or six feet, differing in this respect, from any other species that I have seen living, it not being usual for them to ascend more than one half of this distance.

10. STROPHIA GLABER Novo.

Little Smooth Strophia.

Plate II, 10 & 10B, shell:

DESCRIPTION.

Sp. Ch. Size, very small. Shell, rather heavy. Striations, absent. Teeth, two, both long. Whirls, 9. Examined 16 specimens.

Form of shell, oval, the greatest diameter being at the second whirl, the first and third are but little smaller, and from this last the shell tapers to a blunt point, making an angle of 60 degrees. There are only faintly defined lines of growth which, however, assume more prominence on the back of the upper whirl, but these prominences are widely separated and irregular. The sutures between the whirls are not very deep.

Aperture,rather small, but open, the diameter of the cavity slightly increasing just within the entrance; the lower tooth is placed midway between the two walls, is .16 long and .08 high, and the upper which is situated just above it, measures only .02, but makes a complete turn around the column.

The margin is not produced forward beyond the diameter of the shell, and is somewhat thickened, measuring .08, and the outer posterior portion is provided with a blunt and not prominent edge which is not curved downward. The frontal bar is quite prominent.

Color of shell externally, bluish white marked with abraded patches of purplish yellow. The frontal bar, teeth, and margin, externally and internally, are yellowish, but within the aperture, this color gradually deepens into yellowish purple which pervades the whole interior.

DIMENSIONS.

Size of types, .62 by .33 and .65 by .30. Maximum size, .88 by .34; minimum, .61 by. 32. Greatest diameter, .37; shortest, .30. Longest, .88; shortest, .61.

OBSERVATIONS.

This species bears the same relation to S. parva that S. perplexa does to copia, and though I have seen but comparatively few specimens, I cannot consistently do anything else but name it. There is a tendency to assume both a cylindrical and a short, thick form. As in S. perplexa, there are scattering prominences on many of the whirls of some specimens, but they are not conspicuous enough, ncr uniform enough to be considered striations.

Known from all other species by the absence of striations, small size, and long teeth.

DISTRIBUTION AND HABITS.

This species of Strophia occurs on the west end of Cayman Brac, near the northern terminus of the path that crosses the key near the houses.

I found this species very rare on the margin of the path near the area occupied by S. parva. They were rather solitary in habit, and occurred on the low herbage which offered them an opportunity for concealment.

11. STROPHIA NANA Novo.

Dwarf Strophia.

Plate II. 11, A, B, & C, shell; D, section.

DESCRIPTION.

Sp. Ch. Size, exceedingly small. Shell, moderately heavy. Striations, present. Tentacles, short, about one fourth as long as the eye peduncles. Whirls, 11. Teeth, long. Examined 2,000 specimens.

Form of shell, an elongated cone, with the first whirl the largest; the next three are successively a trifle smaller, then the shell slopes rapidly to a point, making an angle of about 60 degrees. The striations are 18 on the upper whirl, prominent, and excepting on the first whirl, where they are narrower above and enlarged in the middle, are largest at the top, and gradually become narrower, attaining the minimum near the suture, where both they and the shell are depressed below the diameter; from this point to the suture the striations become suddenly enlarged and widened as much as at the beginning above, and are slightly inclined to the left. The striations are not arranged in lines, and are slightly inclined from right to left; the interspaces are a trifle wider than the prominences which are roof-shaped, with the ridge somewhat rounded, and the surface is smooth. The striations are absent on the two or three lowest whirls. The sutures between the whirls are not very deep.

Aperture, large and open, but does not measure any more within than at the entrance. Lower tooth, not very prominent, is .10 long and .02 high, and the upper which is situated just above it, is not at all prominent, being a mere elevation, but more within the cavity is higher, and makes a complete turn around the column.

Margin, not produced forward quite as far as the diameter of the shell, and is inclined slightly backward; it is not thickened, and the outer portion is produced into a thin, but not prominent, edge that is not rolled downward. The frontal bar is quite prominent and interrupts the striations. Animal, not large; eye peduncles, .20 long; tentacles, .05. Jaw, smooth.

Color of shell, externally, dull ashy. The frontal bar, teeth, and margin, internally, are bluish white, but within the aperture this color gradually deepens into pale purplish brown which pervades the whole interior. Color of animal, pale brown, with the minute granulations on the anterior portion of body and head, black.

DIMENSIONS.

Size of types, .62 by .25 and .60 by .18. Largest specimen, 64 by .26; smallest, .53 by .20. Greatest diameter. .28; smallest, .18. Longest specimen, .64; shortest, .53.

OBSERVATIONS.

The type as described and figured on Plate II, 11, A, is the most prevalent, but a more cylindrical form is very common, ib., B, in which there is but very little difference either in diameter or width between the second, third, and fourth whirls, the first being wider, but not much larger in diameter. The specimen figured has the striations far from prominent, but this one is almost, if not wholly, unique in this respect. The remaining form is shorter than the type, but has about the same proportions. The depressed line above the suture, and the inclined enlargment of the base of the striations are some of the singular features of this most remarkable Strophia, and remind one of a similar structure in the genus Chondropoma. The peculiar ashy colors may be partly due to minute, dark. apparently eroded dots, with which the shells are covered. Striations vary from 16 to 20; whirls, 10 or 11.

Known from all other species, by the presence of striations, exceedingly small size, elongated form, and long teeth.

DISTRIBUTION AND HABITS.

The island of Little Cayman is only ten miles long with an average width of two miles, and is thus a mere spot in the waters of the Caribbean Sea, and the Dwarf Strophias occur in a space which is only five or six yards wide by twenty long, on this little key, and as they were rigidly confined to this narrow area, which on a good sized chart of the West Indies, would be more than covered by the point of a fine cambric needle, I consider that this species has the most restricted range of any animal with which I am acquainted. This spot is on the west end of Little Cayman, on the eastern most of the two paths that cross the key, near their junction.

In habit, this species is social, and I found many of them clinging to a kind of heath-like plant which was about eighteen inches high, and which had small gray leaves of nearly the same color as the shells, and which on being crushed, gave out a strong odor. Here these Strophias were exposed to the burning rays of a nearly vertical sun, and the heat in which they lived during the day, was intense. Some, perhaps one third of them, had retreated beneath stones, a situation in which it is rare to find a Strophia, the only other species that I have found in a similar situation, being S. incana from Key West, which retreated from the cold of winter, and one other species occurring in the pine woods on the island of New Providence, to be mentioned later.

It is evident that in this species, we have a Strophia dwarfed to an exteme degree, from feeding on the pungent leaves of the plant described, and isolated as it is by surrounding areas of rough, jagged rocks, the process of diminution has gone as far as it can go and allow the animal to live as a Strophia, with the ordinary habits of Strophia. The ground was strewed with thousands of dead shells, showing that mortality among them was great, and the, perhaps, recently acquired habits of seeking the shelter of rocks is one to which they are driven in order to preserve the species from utter extermination, but it is doubtful whether they will even keep their generic characters under this new mode of existence, For further remarks upon this very interesting subject consult General Conclusions.

12. STROPHIA NUDA Novo.

Naked Strophia.

Plate II, 12 & 12B, shell.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thin. Teeth, two, short. Striations, absent. Examined three specimens. Whirls, 10 & 11.

Form of shell, cylindrical, the first four whirls being about equal in diameter; then the shell curves to a blunt point, making an angle of 65 degrees. There are only faintly defined lines of growth which are more prominent on the upper whirl. Sutures, deep, with whirls bulging.

Aperture, large and open. Lower tooth, placed to right of center, is not prominent, and is .10 long by .03 high; the upper is a mere elevation at the entrance, is larger within, but is short.

Margin, not produced forward quite as far as the diameter of shell, and is inclined slightly to the right; it is thin. Frontal bar, not large.

Color of shell externally and internally, dark flesh, yellowish at apex, and fading to nearly white on margin and teeth. Shell, polished.

DIMENSIONS.

Size of types, 1.00 by .39 and .82 by .32; other specimen, .89 by .38.

OBSERVATIONS.

Although I have only three of this singular Strophia which I found near Clarence Harbor, Long Island, Bahamas, I have ventured to name it, as I have never seen anything like it. Known at once by the cylindrical form, bulging whirls, short teeth, and naked, flesh colored shell.

(CONTINUED.)

DESCRIPTION OF AN APPARENTLY NEW SPECIES OF WARBLER FROM JAMAICA.

The following is a brief description of a Warbler that I found while looking over a collection of bird skins in the museum of the Institute of Jamaica, at Kingston, where permission was kindly given me to name it by the curator, Prof. J. J. Bowery.

DENDRŒCA IGNOTA Novo.

Jamaica Palm Warbler.

Plate, III, 1, head.

DESCRIPTION.

Sp. Ch. Size, moderate, about that of Dendrœca palmarum, to which it bears a general resemblance.

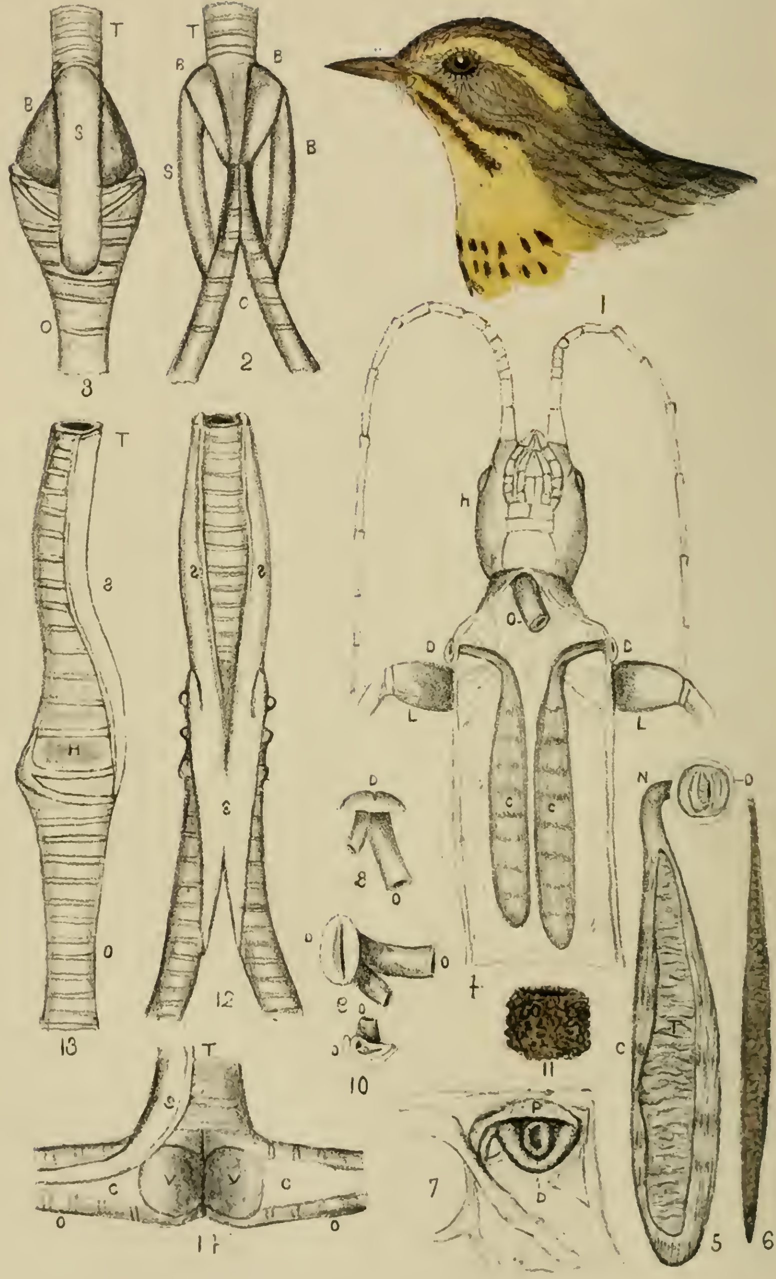
Color. Top of head, dark chestnut, with an indication of a central stripe. Back and sides of head, ashy, tinged with greenish on rump. Wings, brown, with the edges of the feathers lighter. Throat and superciliary stripe, sulphur yellow. Narrow line through cheeks and maxillary stripe, chestnut as in the crown. Remaining under portions, paler yellow than the throat, with narrow stripes of dusky across the breast; abdomen, lighter, but the under tail coverts are yellow. Tail, dark brown, having the two outer feathers spotted with white, terminally.

OBSERVATIONS.

The nearest ally to this species, is D. palmarum, from which it differs in the purer colors beneath, absence of streakings on the sides, and presence of the two stripes on the sides of the head; it is true that in the Yellow Redpoll there is an indication of a maxillary stripe of chestnut in some specimens, but I have never seen it as extended as in this new species. But even if this stripe were common to both birds the other characters given would be sufficient to separate them. There are no other species of Warblers with which Dendrœca ignota can be confounded.

The specimen described, the only one in the collection, was labeled "Hamstead, St. Andrews, April 4th.,–79. J. Goodlet." The type remains in the museum at Kingston.

PLATE III.



C. u. M.

EXPLANATION OF FIGURES ON PLATE III.

1. Dendrœca ignota, Jamaica Palm Warbler, head, life size.

2. Inferior larynx of Chrysotis leucocephala, White-headed Parrot, lower side, twice the size of life; T, trachiea; B, B, bronchialis; O, bronchial tubes.

3. Side view of same, lettered as above.

4. Devil's Horse, Anisomorphia buprestorides, female from Florida. All the figures of this species are greatly enlarged; H, head, with jaws and antennæ; O, beginning of œsophagus; D, gland ducts; C, C, defensive gland;s L, anterior legs.

5. Enlarged gland of the above; D, duct; N, neck; C, longitudinal muscles; T, transverse muscles.

6. Inner core of gland, the orifice being above.

7. Right side of portion of thorax near the neck, showing external orifice of gland and surrounding elevated, ornamental lines; D, duct; P, elevation above it.

8. Tubercle of true spiracle detached; D, duct; O, air tube.

9. Side view of same, with same lettering.

10. Tubercle of apparently functionless spiracle, lettered as above.

11. Section of inner core of gland, showing corrugated surface.

12. Inferior larynx of Quail, Ortyx virginianus; S, S, S, sterno-trachealis.

13. Side view of same; T, trachea; S, sterno-trachealis; H, vibratory membrane on side of larynx; O, bronchial tubes.

14. Lower portion of same; T, trachea; S, sterno-trachealis; O, O, bronchial tubes; C, C, tympaniform membranes; V, V, vibratory membrane below larynx.

THE DEFENSIVE GLANDS OF A SPECIES OF PHASMA, ANISOMORPHA BUPRESTOIDES FROM FLORIDA.

During the middle of October, 1887, a series of heavy rains occurred on several successive days, in Orange County, Florida, and as considerable water fell during this time, the lower section of the country was submerged. Many insects were driven from their retreats by this flood, taking refuge on the shrubbery. Among them were a number of the large species of walking-stick, or phasma, common in Florida, (Anisomorpha buprestoides) and I thus had an excellent opportunity of observing the peculiar bombarding apparatus with which this animal is armed. The devil's horses, as they are called by the negroes, were in pairs, the females being evidently about to deposit their eggs. I usually found them lying quietly in a fold of a frond of the saw palmetto, with the legs close to the body, and the antennæ together and pointing straight forward, while the comparatively diminutive male which is never more than one third as large as the female, lay close beside his mate, always clinging to her whenever she moved, and was thus carried by her. Both were very sluggish, not moving until actually touched, then the female raised herself slowly on her long legs and straightway their emerged two streams of a vaporous fluid, from the upper angle of the thorax, near the neck. These streams were directed forward, but at a slight angle outwardly and upward, that is when the insect was resting on a horizontal surface. When the matter discharged, first leaves the erifice from which it is expelled, it is a milky fluid, but as it is, apparently, as volatile as ether, it almost instantly assumes the form of vapor, and is projected at least six inches. This fluid has a most peculiar pungent or peppery odor, and although the moisture from it dries away very quickly from any object with which it comes in contact, the odor is retained for a long time. The fluid when thrown against the hand, has no perceptible effect on the skin, but I have been told repeatedly by the negroes, that its effect upon the eyes is very painful.

Later in the season, I found this phasma very common under the bark of partly decayed, prostrate trees, in the vicinity of Jacksonvtlle, and here I collected a number cf them in alcohol, and then observed that this milky fluid was readily soluble in alcohol, not a vestige remaining in the glands in a few moments after the insect was submerged.

At this place, I met a negro who was cutting wood, and showing him one of the devil's horses, asked if he found many of them. He at once assured me that they were common, too common, in fact, as they gave him considerable trouble; they would crawl out from beneath the scales of bark on the pines, when the strokes of his axe began to jar the trees, and thus frequently succeeded in throwing the vapor into his eyes.. This caused intense smarting for a time, but the effects were not lasting,and no permanent injury to the eyes resulted from it.

Judging from the quantity of excrement in their retreats, I should think that a single pair occupy one place for some time. During October and the first week in November, I did not find a single unmated female, but found several single males, hence it is probable that, like many species of animals, the males predominate. Later in the season, in December and on until spring, I have found both sexes living apart.

The devil's horse is similar in form to the common walking-stick, but is somewhat stouter, with proportionately shorter legs. The females will average three inches in length, and are deep chocolate brown in color, with two dull orange stripes beginning on the top of the head and running backward along the body and abdomen. The males are not more than half the length of the females, are proportionately more slender and paler in color. There are three sets of spiracles, or breathing holes, one behind each of the three pairs of legs, and one above the last pair, while each of these has its special ramification of air tubes internally. There are also six other sets of spiracles, one pair to each joint, excepting the last two, but I think that these abdominal sets are functionless, or have the air tubes only slightly developed. I mention these spiracles because the external surfaces of the bombarding glands, which as I have remarked, open on the upper angle of the thorax, near the neck, have been mistaken for spiracles, and may indeed be modifications of such, but they now perform a very different part as I have shown, and the following is a description of the internal and other structure, as well as I could make it out from alcoholic specimens.

The bombarding glands, Plate III, 4, c, c, where are given enlarged figures of them, lie along the back, beneath the first or thoratic segment. The insect is represented in the plate, as lying on its back with the lower walls of the body, stomach, and intervening organs removed. The glands narrow gradually anteriorly until they assume a tubular form. The tubes are bent outward and terminate in a duct very near the upper anterior angle of the thorax, ib., 4, D, D, thus just in advance of the fore legs, ib., 4, L, L. One gland, usually the right, is shorter than the other, but I have found both glands of the same size, and sometimes the left will be shorter than the right. The glands in alcoholic specimens, are about .25 long in the female, and about half this length in the male which discharges his fluid with evident reluctance, and but a small quantity is thrown out. The blind ends of the glands are rounded and the body of them is flattened, while both surfaces are undulating. The walls are made up of two sets of muscles, an outer in which the fibers are placed longitudinally, see ib., 5, C, and the inner which is much thicker and in which the fibers are in transverse rings, ib,, 5, T, the fibers themselves being quite loosely arranged and flattened laterally.

Within the second wall, is a spindle-shaped sack, but quite narrow, black in color, very rugose on the outer surface. and smooth within, see ib., 6 and 11, where is given a greatly enlarged section. The anterior end of the sack enters the neck of the gland. ib., 5, N, and terminates in the orifice. This peculiarly corrugated skin of the inner sack may secrete the volitile fluid, while the two sets of quite powerful muscles serve to eject it, and that too very forcibly, as already shown. The peculiar, loose structure of the inner muscular fibers which, although spirally arranged, are not continuous, led me to believe that they were modified air tubes, and that the orifices were modified spiracles. This hypothesis is, in a measure, confirmed upon examining the true spiracles and those that are nearly or wholly functionless. The air supplying spiracles open in a tubercle, ib., 8, in a transverse orifice, ib., 8 & 9, D; O, being the air tubes severed near their external terminus. The orifice extends nearly across the tubercle, and closes with a peculiar valve, the edge of the lower side being thinned, it slips beneath the upper, most effectually closing the entrance to the tube. This is illustrated in ib., 9, where the thinned edge of the lower valve is shaded.

Upon referring to ib., 5, D, a quite similar arrangment will be seen in the closing valve of the bombarding gland, but the external character of this orifice, or rather the immediate surroundings of it, are more those of the functionless spiracles, one of which is illustrated in ib. 10. Here the transverse fissure is present, but only a minute orifice is open and this is evidently never closed. The comma-shaped fissure is surrounded by a ridge, and below is a second elevation. By referring to ib., 7, D, both these ridges can be seen in the right orifice of a bombarding gland, P, above, being a still more elevated, protruding ridge or tubercle, this has evidently been modified from the terminus of one of the several ornamental ridges that occur on the sides of the thorax. From its position, I should judge that if the bombarding glands were ever spiracles, the air tubes were nearly functionless and hence their walls were thicker than those of the true air tubes, much as are the shorter tubes, now present in the more posterior spiracles, consequently would have been more readily modified.

The figures were all drawn from females taken from beneath the bark of prostrate pine trees near Jacksonville, Florida, the first week in November, 1887.

Although many members of the order to which this phasma belongs, discharge a thick, dark fluid from the mouth, I am not certain that it can be regarded as defensive. Perhaps the children's idea that the grasshopper's "molasses" is given as a propitiatory offering to insure freedom when captured is not far from correct. The presence of these defensive glands in the devil's horse is therefore rather unexpected in an orthopteran, but the presence of similar glands is far from being unique among other insects. Among Coleoptera, the well known bombardier beetles discharge, when disturbed, a pungent gas, with a slight report, from the abdomen. Nearly all species of certain genera of bugs give out disagreeable odors, while some of the lepidopterous insects possess glands that emit unpleasant odors. Such glands are found in the retractile horns in the larvæ of the swallow-tailed butterflies, and such strong odors are given out by a genus of moths that Dr. Harris speaks of one of them as the stinking moth, while the scarlet-winged bella moth exudes an orange colored fluid from its thorax that has an unpleasant odor. The acid smell from ants is well known, while other hymenopterous insects give out strong odors.

Ascending in the scale of animal life, we find many of the mollusks not only ejecting the watery fluids contained within the body, often with considerable force, as a defensive measure, but some of them, for example among the purpuras, exude colored fluids that sometimes emit strong odors, while the cuttle-fishes possess the power of surrounding themselves with an inky fluid in which they conceal themselves, and some of this family of mollusks squirt a stream of water to a considerable height in the air. I was told by my Bahaman boatman who called my attention to a cuttle-fish that was hidden in a hole of a rock, from which it would emerge, raise its head above the shallow water, and eject a stream of fluid, water apparently, that this was poison.

Among mammals, those which possess glands that emit offensive or other odors, are very numerous, of which the skunks are the best known, while the llama ejects a fluid or mucus from its nostrils, blowing it to a considerable distance.

As early as 1865, I became aware that these phasmas emitted a defensive fluid, and in the spring of 1875, I saw some drawings of the glands of an allied species, made by Dr. J. Walter Fewkes. Say was the first to publish any account of the habit of discharging the defensive fluid. Mr. S. H. Scudder published an interesting account of the habits of this species as given him by a correspondent, and describes the position and form of the glands of this, and of an allied species from Central America, in Psyche, Vol. I, No. 22; Feb., 1876.

Although I have handled hundreds of a closely allied species that lives in the air plants on the Bahamas, I have never seen them discharge any fluid; they have, however, a peculiar odor and may possess glands. I have failed to find any glands in the thorax of our common walking-stick, Diapheromera femorata, or any rudiment of them.

THE STERNO-TRACHEALIS AS A VOCAL MUSCLE.

The sterno-trachealis in birds is a muscle, or rather a pair of muscles, that have their origin on the sides of the trachea at a greater or less distance above the inferior larynx, quite above all the other laryngeal muscles in species that have not the power of modulating the voice to any great extent, but below some of these muscles in the birds that do possess this power to a very great degree. In the great majority of species, this muscle, as its name, sterno-trachealis, implies, connects the sternum with the trachea, being attached to the former on its costal process, a projection of the main bone that arises near the junction of the coracoids with the sternum.

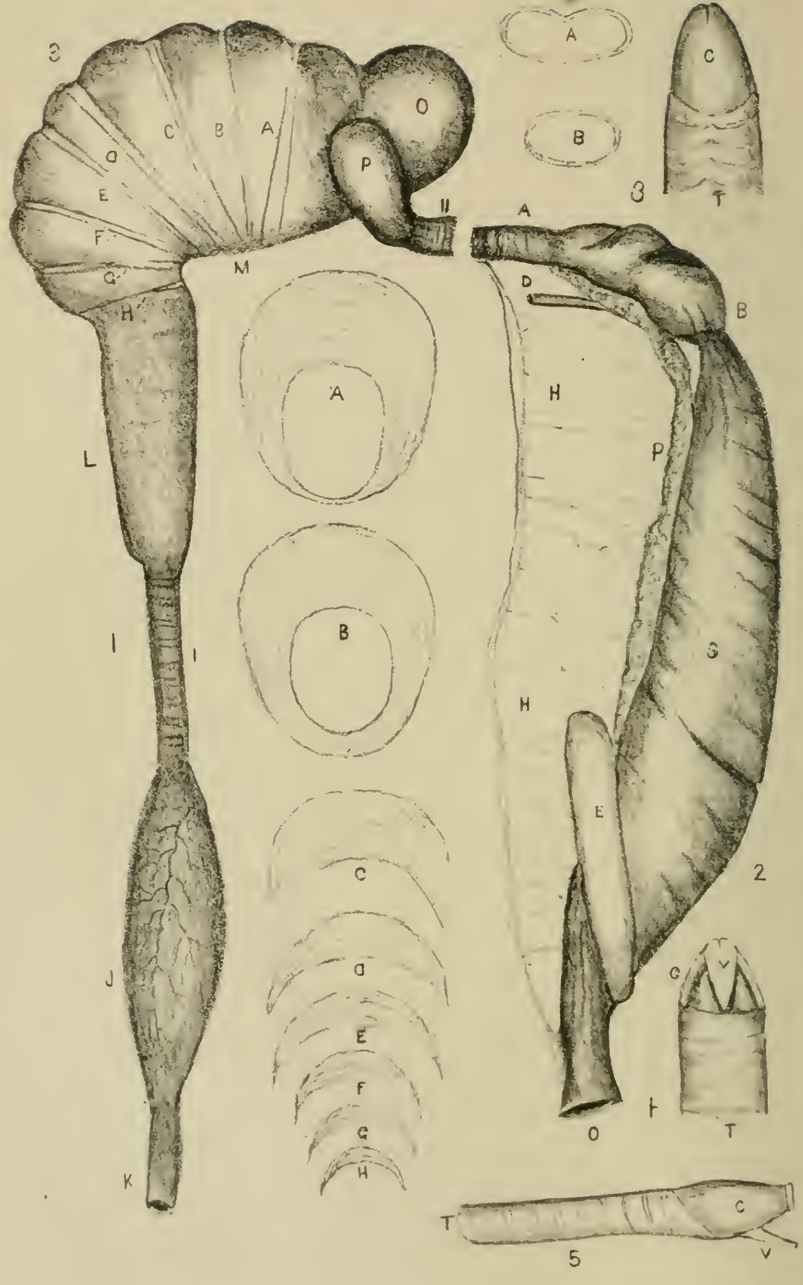
The presence of the sterno-trachealis is the rule, its absence the rare exception, the three or four species of humming birds that I have dissected, and the roseate spoonbill, are the only birds that have come under my notice in which it was not present. The attachment of the sterno-trachealis to the sternum, or at least to some part of the scapula arch, is so constantly the rule that its presence without such an attachment becomes at once remarkable. It is with these very cases, that I shall deal in this article, as they prove most conclusively that in many instances the sterno-trachealis is a direct, and in fact, the only agent that controls the vibrations of the tympaniform membranes which lie on the inner side of the bronchial tubes.

Anatomists have generally considered this muscle of no great importance in producing sound, and have accordingly assigned only five pairs of vocal muscles even to the highest group of singing birds. In 1878, in my Birds of Eastern North America, I stated that I considered that the group Oscines, (true song birds) had six pairs of vocal muscles, yet gave no proof of it beyond the simple statement, but that proof is now advanced.

Last April, 1888, when on the island of Cayman Brac, I made a dissection of a parrot that occurs there, Chrysotis leucocephala, or a species closely allied, and the first thing that I observed, was the apparent absence of a sterno-trachealis, a second glance, however, informed me that I was mistaken; the muscle was present, but had no sternal attachment, was greatly thickened and shortened, while it extended from just above the larynx, see Plate III, 2 & 3, where figures twice the size of life are given, to a point on the upper portion of the bronchial tubes, ib., o, without any adhesion to the intermediate section, as will be seen at ib., 2, where a view of the lower side of the larynx is given. At the point of junction of the muscles with the bronchial tubes, the half rings are fused together. The tympaniform membrane extends the whole length of the inner side of the short bronchial tubes and, as the os transversale and its accompanying semilunar membrane, and the membrane between the bones of the larynx, sometimes found in parrots, are absent, is the only vibratory, or sound producing, membrane in the possession of the bird. Now as this Cayman parrot is not at all inferior to other members of the family, in producing a variety of discordant cries, and as the superior larynx is no better developed than in most birds, and must play a very minor part in producing vocal sound, those noises must be caused by this membrane, governed in a great measure, by the sterno-trachealis. To be sure, the upper portion of the membrane is tightened and relaxed to a slight degree, by the rather stout bronchialis, ib., B, but the sterno-trachealis certainly does most of the work.

Least some should now consider that my point is not proved, I will bring a witness on to the stand that will give even more conclusive proof, which can be consulted by everybody, and which will be nothing more than our common quail, Ortyx virginianus. In this bird, the sterno-trachealis has its origin well up on the sides of the trachea, Plate III, 12, 13, 14, s, all of the figures being three times life size, adheres to it as it passes downward, until it reaches a point .25 above the larynx, when it becomes free, and so continues until it passes around the trachea and adheres to the six bony laryngeal half rings on the upper side, and comes in contact with its fellow below them, ib., 12, at the lower s; it then sends a spur down along the short tympaniform membrane to govern it, ib., 14, s, muscle, and c, tympaniform. On the inside of the laryngeal half rings, just above the tympaniform membranes, is a pair

PLATE IV.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EXPLANATION OF FIGURES ON PLATE IV.

Alimentary canal and superior larynx of a West Indian lizard, Cyclura nubila.

1. Cæcum and cloaca; H, intestine; P, pyloric lobe; O, spherical projection of cæcum; A to H, inclusive, constrictions of valves, while the separated valves below are lettered the same, but are reversed in position; M, concave side of cæcum, where the valves are the largest; S, convex side of same, where the valves are the smallest, or are represented by constrictions; L, enlarged intestine; I, constricted portion of same; J, cloaca; K, rectum.

2. Stomach and accessory organs: A, intestine; B, valvular constriction in stomach; D, gall duct; E, spleen; H, H, absorbents; O, gullet; S, main body of stomach.

3. Larynx: C, upper portion; T, trachea; A, section of trachea near bronchial tubes; B, same near larynx.

4. Larynx: C, lower side; T, trachea; V, valve.

5. Larynx: C, side view: T, trachea; V, valve.

of circular membranes that are vibratory, therefore aid in producing sound, ib., 14, v, v, the bronchial tubes being drawn apart in the figure. These membranes are rendered tight or are loosened by the partial revolution, or the oscillation, of the laryngeal half rings, and this motion is imparted to them by the sterno-trachealis. At ib., II, may be seen one of another pair of vibratory membranes lying between the bones of the larynx. As the sterno-trachealis is the only laryngeal muscle with which the quail is provided, it must be the cause of all the notes the bird utters, and consequently fully establishes its claim to be considered a true vocal muscle.

In an article which is to appear in the next number of Contributions to Science, I shall go a step further and show that all the lower notes, that is, low in pitch not in sound, for example, the hooting of owls, the pumping of the bittern, the singular bubbling notes of the snowy heron, the booming of the night hawk, and even the drumming of the ruffed grouse, are produced by the action of the sterno-trachealis on the tympaniform membranes, drawn from conclusions to which I have arrived after making an examination of the larynx of hundreds of species of birds, which I began to illustrate with drawings in 1875, and have continued, whenever opportunity offered, ever since.

PECULIAR STRUCTURE OF THE CÆCUM OF A LEAF-EATING LIZARD, CYCLURA NUBILA.

On the two smaller Cayman Islands lives a large lizard, an iguana, Cyclura nubila, which although rare on Cayman Brac, is much more common on Little Cayman, and is also found on some of the other West Indies. This lizard which sometimes grows to be five feet long, subsists probably wholly upon leaves, and often ascends trees to obtain them. One that I dissected, taken on Cayman Brac, was about four feet and a half long, and was filled with a peculiar, tough, rather thick leaf of a tree called balsam.

The œsophagus, or gullet, is 18 inches long to the proventriculus, or first stomach, Plate IV, 1, o, all the figures given being one half life size, and is provided with numerous glands that secrete a solvent fluid.

These glands are arranged in about eight folds, and the proventriculus is three inches long, terminating at a deep fold, just below ib., S.

The partly marcerated food now enters the stomach which is some six inches long, with rather thin walls, having a soft lining membrane. At its beginning, the stomach is about an inch and a half in diameter, from this it gradually tapers to a point about two thirds its length, ib, B, where there is a kind of valvular constriction, then an irregularly formed enlargment to the beginning of the intestine, ib., A.

The spleen, ib., E, lies on the proventriculus, and the somewhat granular appearing pancreas, ib., P, lies along the curve of the stomach; H, H, represent the absorbents, and at D is the gall duct.

The break in the intestines in the plate between A and U represents a space of 18 inches in which the intestine is of about the same size.

Beyond this, the intestine now becomes enlarged into a kind of pyloric sack, ib.,P, which opens without any valve into the body of the cæcum. This organ is five inches long by some two and a half in the widest portion, and is bent at nearly right angles. It begins in a globular sack that projects beyond the opening, ib., O. Within the opening, is a series of eight thin valves that are formed by pushing inward a portion of the wall and its accompanying mucous membrane. Outwardly these valves appear as mere constrictions, with the interspaces slightly bulging, and these interspaces are much wider above than below. The first valve, ib., A, completely encircles the interior, and has an orifice on the lower side, ib., lower A, where a series of the detached valves are given, lettered the same as in the above, but are reversed in position. The next valve, B, also encircles the cavity, and has a smaller orifice, C, begins on the concave side, and does not encircle the cavity, but is crescent-shaped, and each following valve is successively smaller, until reduced to a mere elevation at H.

The intestine, ib. L, continues enlarged after leaving the cæcum for four inches, then contracts suddenly, maintaining this diameter for four inches, ib., I, then enlarges into an elongated cloaca, ib., J, the greatest diameter of which is in the middle, and which is five inches long. The cloaca opens directly into the rectum, K.

This singular intestinal system of valves has evidently arisen from the leaf-eating habits of the animal, in order to retain the coarse, slowly digesting food in the alimentary canal as long as possible, so that all the nutriment might be extracted. The bud and leaf feeding grouse, among birds, are provided with a pair of greatly lengthened cæca, answering an exactly identical purpose, although constructed on quite a different plan.

Nor is this cæcum all the modification that this animal has undergone; there is a peculiarity of the superior larynx that is worth noting. The trachea is flattened, and near the bronchial tubes, is grooved above. Sections are given at ib., 3, A being the lower portion and B the upper. C is the upper portion of the larynx; ib., 4, the lower. The opening to the trachea is on the lower side, and is guarded by a valve, ib., 4, V, that is constantly open unless the larynx is pressed down upon it from above, when it closes but leaves a narrow slit at the extremity open, enabling the animal to breath when its mouth is filled with leaves, while the flattened trachea permits the passage of this kind of food along the gullet beneath it, with a greater ease than if it were round. A side view of the tracheal valve is given at ib., 3, with the same lettering as above.

The specimen from which I made the drawings was a male, and was captured by one of the natives, but on April 31, I saw a smaller specimen, a female, on the east end of Little Cayman, making her way over the rough rocks of the iron shore. Although she saw me as I approached, she could not hasten her movements greatly, on account of the rough jagged rocks, and I easily shot her. The ovaries contained eight spherical eggs, still without shells, and were an inch in diameter.

NOTES ON SOME JAMAICA BIRDS.

While looking over the birds in the museum of the Institute of Jamaica, I found the following noteworthy species.

Rallus coryi, Cory's Rail. I found a fine specimen of this rare bird among some duplicate skins. It was taken in the vicinity of Kingston in autumn and is in every way typical. The only known specimen besides this in collections, I shot on April 29, 1884, on the south shore of Andros, Bahamas.

Helmitherus swainsoni, Swainson's Warbler. Judging from the number of duplicate skins of this species, labeled as having been taken from early autumn until late in spring, this must be quite common winter bird in Jamaica.

Buteo borealis, Red-tailed Hawk. Was represented by several specimens.

Falco peregrinus, Duck Hawk. I found a single specimen in the collection.

Cathartes aura, Turkey Buzzard. I was rather surprised to find that this species was the only vulture in and about Kingston. The native name of John Crow applied to it, is misleading, as with us this belongs to the Black Vulture, C. atrata, which I did not see at all on the island. As the birds were rigidly protected by law, they were very tame, and three or four could frequently be seen, even in the principal streets, quarreling over the carcass of some fowl or cat that had been thrown out, to be removed by these supervisors of the board of health.

DESCRIPTION OF A SUPPOSED NEW SPECIES OF GANNET.

The following is a description of a species of Gannet that I obtained on the island of Little Cayman, in April, 1888. Misled by circumstances, and having no convenient opportunity of comparing the specimens taken with other species, I supposed, until recently, that they were the Blue faced Gannet, Sula cyanops; greatly to my surprise, however, upon looking up the matter, I find that they not only differ very much from that species, but are unlike any other Gannet that I ever saw, or that I find described. This is the species given by Mr. Cory as Sula cyanops, in a list of birds taken by me on Cayman Brac and Little Cayman, published in the Auk for January, 1889, pages 31 and 32. I have dedicated the species to Mr. Charles B. Cory, who has done more than any one else towards extending our knowledge of West Indian Birds.

SULA CORYI Novo.

Cory's Gannet.

Plate V, heads of types, 1, adult; 2, young.

DESCRIPTION.

Sp. Ch. Color, similar to that of the Common Gannet, Sula bassana, but the form and size are those of the Red-faced Gannet, Sula piscator, from which it differs, even in the young of the second year, in having the tail wholly white.

Form, rather slender. Size, small. Bill, quite smooth, without showing the scaling, usually so prominent in members of this genus, very much; there is a groove extending from the base of the upper mandible to near the tip; an inch from the tip, an oblique groove, about .30 long, extends to the top of the bill, but does not quite meet its fellow on the opposite side, and there is a notched scale on either side, in front of the gape, with the division from the bill prominent in front, but to which the skin of the face adheres above. The lower mandible is wholly without grooves or scales. In form, the upper mandible is considerably depressed along the culman, and but slightly swollen at the base, while terminally, beyond the upward branching groove, it is strongly curved. The outline of the lower mandible shows a slightly upward curve, then is a very little swollen near the tip, below the curve of the upper. Both mandibles are depressed on the sides for two thirds their length, and are toothed for a little more than one half their terminal length, the teeth being irregular in size, and pointing backward. The face is naked about .25 on the forehead, and curves back of the forehead about the same distance, then descends obliquely backward to within .05 of the gape, where the gula sac begins. The gula sac is not prominent nor much wrinkled, and the feather outline at the base, is very nearly straight, being but slightly curved forward. The feet are rather slender; the tarsus is about half the length of the middle toe and claw; the hind toe is half the length of the inner; the inner with its claw, is somewhat shorter than the middle without the claw, while the middle and outer, without the claws, are equal; the claws are all strongly curved, and those of the hind and outer toes are equal in size, while that of the inner is one fourth longer, and that of the middle, one third longer than it. The claw of the middle toe is pectinated, the notches being irregular.

The scalings on the tarsi are fine, and five angled, as are those on the webs; on the toes, at the joints, and terminally, the scales extend quite across, elsewhere on the toes they are double.

The outlines of the webs between the front toes are nearly straight, while that between the hind and inner toes is curved outward, and all of the webs grow forward, at point of junction terminally, encroaching on the nail.

The wings are long, narrow, and pointed; the first quill is longest, and the others shorter in gradual succession, the difference between each being about 1.25. In the closed wing, the longest secondary reaches a point between the 4th. and 5th. primaries. The inner scapularies are but slightly elongated, and are not acutely pointed. Tail, pointed, the two central feathers being one fourth longer than the next pair, then the gradation is about .75, but the outer are not quite one half as long as the middle.

Birds in the mixed dress and in the brown plumage, being younger, have the groovings on the bill deeper, and consequently the scalings are more prominent. In this stage, the tail is not as long.

Birds in the first feathers, which have never flown at all, have the groovings of the bill less strongly marked than the adults, the middle toe is but slightly notched, the 2d. primary is a little longer than the 1st., and all of the primaries are sharply pointed, but they are at least .25 narrower than those of the adults, while on the other hand, the tail feathers are not only (excepting the central) longer, but are, at least, .25 broader than those of the adults, and all the remainder of the plumage is longer. There are no teeth on the bill.

Nestlings in the down, at first show a much shorter curve to the bill, and the terminal portion of the lower mandible is more prominent, but as the egg-tooth disappears, these peculiarities gradually merge into the next stage. In assuming the feathers, the primaries and secondaries appear almost simultaneously, when the birds are about half grown, then come the tail feathers, but the birds are as large as the adults, weighing even more, before the body is clothed with feathers. The head and neck retain the down the longest, and it is not unusual to see fully fledged birds with a tuft of down on top of the head.

I will not here give the anatomical structure, as I am preparing a special paper, illustrated, on portions of the comparative anatomy of three members of this genus, Sula bassana, fiber, and coryi, to appear in the second number of Contributions to Science.

COLOR. ADULT. Primaries, first row of coverts, spurious wing, exposed portion of secondaries, and middle lower wing coverts, dark brown. Remainder of plumage, tinged with creamy, which on the top of the head, and upper tail coverts, becomes nearly orange. Outer portion of wing feathers, hoary. Bill, purplish blue, more decidedly purple at base. Face and gula sac, bluish, with the latter purple at the base. Iris, brown. Feet, crimson lake. These are the colors in life, but the gula sac dries yellowish and the other parts become paler. Sexes, similar in all stages.

YOUNGER. Similar to the adult on head, neck and below, but the upper portions are mottled irregularly with slaty brown, and the outer portion of tail is brownish. An unusual plumage, see Observations.

YOUNG, 2D. & 3D. YEARS. Slaty brown, tinged with creamy or yellowish, especially on head and neck, excepting rump, upper and under tail coverts, and tail, which are white, and many specimens have the lower back also white. Wings, naked parts and iris, as in the adult.

FIRST PLUMAGE. Sooty brown throughout, darkest on the wings and tail, with the feathers hoary outwardly on the former, lightest below, and some of the feathers above are margined with lighter. Bill, face, and gula sac, black, the latter tinged with yellow. Feet, very pale yellow.

NESTLINGS. Pure white, with the down very thick and long. The wing and tail feathers appear long before the others, then follow the scapularies, then the feathers of the back, then those of the body, while the head and neck are covered last, and the bird has assumed the first plumage as described. Iris, in this and in the last, blue. Bill and feet, as in the last.

DIMENSIONS.

Wing, 14.25 to 15.00; tail, 9.00 to 9.50; bill, culman 3.15 to 3.40, depth at base, 1.00 to 1.19; tarsus, 1.20 to 1.40.

OBSERVATIONS.

In the adult stage this species is remarkably uniform in coloration, and the same is true of nestlings, and the first feathering, but in the intermediate stages, there is much more variation. In the plumage succeeding the adult, which appears to occur much too seldom to be assumed by all birds, there is great variation, scarcely any two birds being colored exactly alike. Usually the white color predominates, but I have seen the brown in the ascendency, especially above, while the white below is often mottled with it. This dress is certainly not normal, for, judging from the specimens examined in the gannetry at Little Cayman where there were some 10,000 birds, not one in a hundred is thus colored.

The next younger stage varies in amount of white on the back, where it sometimes reaches well up between the wings and extends along the sides below. The tail and its coverts appear to be the first portion to become white, and as shown, as a rule, this becomes wholly of this color in the second year, but in one specimen, out of all I have, three outer feathers are brown, but the upper and under coverts are white. The usual variation in this stage is undoubtedly due to age, but there is no fixed limit which will determine whether birds so marked belong to the second or third year.

It is possible, that what I have above considered as an abnormal plumage may be the young of the Red-faced Gannet, or reversion toward that species; this is rendered more probable by the amount of brown on the tail, as younger birds in typical plumage, have the tail wholly white.

Were it not for the fact, that the young, even in the second year, have the tail wholly white, I should be inclined to consider the adults simply as a very high plumage of the Red-faced Gannet, but in the face of this fact, Cory's Gannet must be distinct from that species, and I knew of nothing else with which it can be confounded. S. cyanops is a much larger bird, wing being over 16.00, instead of 15.00 and under, and has much more brown on the wing, as well as having the tail constantly brown.

The types, and all of the specimens that I obtained, were taken on Little Cayman, but there was a Gannet breeding on the cliffs at the east end of Cayman Brac, which may have been this species, but of this I am not now certain, as I never saw one near enough to identify it.

In this connection, it may be well to inquire into the claims which Sula piscator, Red-faced Gannet, has to be considered as a bird of the insular fauna of the Caribbean Sea. It is true that it has been given as occurring on the Pedro Keys, off Jamaica, but may this not be S. coryi?

HABITS.

The island of Cayman Brac lies in the Caribbean Sea, about one hundred and twenty miles due south of the middle portion of Cuba, and nearly the same distance north west of Jamaica. I left Kingston on the morning of March 18, 1888, on board a small schooner, outward bound for Grand Cayman, but for a consideration, the captain agreed to drop me on Cayman Brac, and by daylight on the second day, we were off the east end of that island.

Cayman Brac is a small key, twelve miles long by an average width of two miles, the eastern end is high, cliffs rising abruptly from the sea to the height of one hundred and eighty feet, but on the northern and southern sides, this pile of rock is bordered by a strip of intervale or lowland, several hundred yards wide, though even here the cliffs maintain their precipitous character.

As we rounded the head of the key and opened the cliffs on the north side, I immediately saw that there was a large number of birds flying about their rocky sides. A moment's inspection proved that these were Tropic Birds, Phæton flavirostris, and a species of Gannet. I landed on the west end of the island where there are no cliffs, and upon inquiring, found that the Gannets were breeding at the east end, but that I could procure them much more readily on Little Cayman which lies seven miles to the westward of Cayman Brac. After collecting awhile on Cayman Brac, I went to Little Cayman, where, through the courtesy of Mr. J. E. Hunter, I found comfortable quarters in the house erected by a company who had been mining phosphate. I was, however, entirely alone, and here I remained sixteen days, having a most excellent opportunity of studying the Blue-faced Gannet and Man-of-war Birds.

On the south side of Little Cayman, near the west end, is the only settlement on the key. It consists of some ten small houses, scattered along the shore for about half a mile, which are owned by two families and their immediate descendants, the Scotts and Boddens, to whom I am indebted for many acts of kindness during my stay on the island. As all of the original settlers of the key are now living, the history of the inhabitants of Little Cayman, is easily written.

Between the houses and the sea is a grove of fine cocoa-nut trees, which extends along the shore to the eastward for about a mile and a half beyond the houses, terminating at a large mangrove swamp, that stretches from the water some distance back into the interior. Bordering the cocoa-nut walk, as it is called, is a growth of low trees averaging some twenty feet high. They are mainly the sea-grape which, although further north, on the Bahamas and Florida Keys, is nothing but a trailing shrub, or at best, only reaches the height of some ten feet, here becomes quite a large tree, having long branches and a very wide, flat top.

These trees, beginning at a point about four hundred yards east of the house of Capt. Scott, the last in the line, and extending to the swamp, were occupied by the nests of the Blue-faced Gannets, and they also built on the outermost of the mangroves but did not extend far into the swamp. The nests were very numerous, five or six being placed on every tree; as this locality had been occupied for many years, a large number of the trees had been killed by the droppings from the birds, and on the long, naked branches, were perched thousands of Gannets, sitting side by side in rows, a motley array, consisting of all stages of plumage, from the newly fledged, wholly dark brown young, to the creamy dress of the perfect adult. Almost every nest was tenanted by a young bird, usually well grown, clad in a beautiful garment of long, pure white down, from which protruded the dark brown wings and tail, while the air was filled with hundreds of birds, departing and returning from fishing excursions, giving utterance, as they came and went, to harsh cries that were answered by those perching, consequently the place was constantly resonant with sound.

The most remarkable thing about this gannetry, was its situation in such close proximity, not only to the houses, but to the cocoa-nut grove in which the inhabitants were constantly at work, for the birds could have retreated to the fastnesses of the mangrove swamp, where they would have been perfectly secure from intrusion. The people, however, never disturbed the birds much, at most only taking a few eggs at the beginning of the nesting season, for cooking. They informed me that the Gannets had formally occupied a small key, containing about three acres, that lay just opposite the present gannetry, a few hundred yards from the shore; but this spot was burned over, some thirty years ago, when the birds all removed to the section now occupied by them. Since that time the birds have been steadily increasing in numbers, and have considerably extended their breeding range. The presence of the Gannets was regarded favorably, as they not only killed the trees, thereby opening spaces in which cocoa-nuts could be planted, but also greatly enriched the soil.

Although, through the courtesy of the owners of the land, I was permitted to examine the gannetry, and select what birds I pleased, I was requested not to shoot within the place, and any wholesale slaughter or taking of eggs, would have been prohibited. I am therefore happy to be able to record the fact, that here is one breeding ground which will long remain undisturbed by the ruthless collector.

I have said that I did not shoot at all in the gannetry, yet managed with the greatest ease to secure all of the birds which I wanted. It has been my good fortune to visit many extensive breeding grounds of birds, but I must say that in all my experience, I never saw any birds so utterly regardless of human beings, as were not only the Gannets but also the Man-of-war Birds, on Little Cayman. Owing to this extreme tameness, I had an excellent opportunity to study their habits, and to secure birds in all stages of plumage, but I have to say, that this latter named task was very distasteful, and although impelled by the claims of science, it was with extreme reluctance that I took the lives of any of these birds.

As I have remarked, most of the nests contained young that were well grown, but some held newly hatched young and occasionally an egg. I say nests, but the structures no more deserve the name than do the ill constructed fabrics of the Night Heron, which they resemble, being a mere platform of sticks.

Eggs were, however, very rare, while they usually contained large embryos, but I succeeded in finding four or five addled specimens. In all cases, with one exception, I found a single young or egg, and the egg, whether spoiled or not, was jealously guarded by one of the parents, for both sexes incubated.

This care of their offsprings was extended to such an extreme degree, that I found a Gannet sitting on an abortive egg that was not more than one third the usual size. In the case where I found more than one egg, there was a pair, one addled and one in an advanced state of incubation; thus in this case, the birds evidently discovered that something was amiss with the first egg deposited, and so laid another, but so strong is the instinct for perpetuation of the species developed, that I do not think, that, as a rule, an addled egg is abandoned by the parents until it actually bursts through the accumulation of gasses within it. It may seem, at first sight, that such an extreme following of instinct, would tend to defeat its object, and so it might, — owing to this care — were it not, that the cases, wherein infertile eggs occur, are very rare: so rare, in fact, that the birds have not learned to recognize them.

This extreme instinctive care of the young may be partly due to the fact there is but one, and time would be required to rear another, and partly to the fact that in all probability the embryo is easily destroyed. I judge that this is the case from my observations of the newly hatched young. They are born perfectly naked, and cannot endure a few degrees of change of temperature without perishing. I removed a young Gannet, evidently some two days old, from the nest, in order to make a drawing of it, and at noon time, when the thermometer must have stood at eighty-five degrees above zero, carried it in my collecting basket across the key, and when I arrived at my house, at the end of perhaps an hour, the bird had nearly perished from cold. I at once placed it in the door-way, in the sun-light, but in a draught of air, when it revived and sat up, but upon looking at it fifteen minutes afterwards I found it completely dead, having been killed by the heat of the sun.

This almost abnormal sensitiveness to change of temperature in the young of Cory's Gannet has probably increased through the fostering care of generations of parents, while it is quite likely that the origin of the several species of small Gannets, with comparatively delicate proportions, that occur in the tropics, can be ascribed to this habit which must tend to degrade a species, at least, physically.

This hypothesis becomes more plausible, when we consider that the sensitiveness is not exhibited, to any marked degree, by the naked young of the stronger, larger, northern breeding Common Gannet, Sula bassana, which occupy a wide-spread region, to the exclusion of all other species. Migration, in the case of the northern bird, may have something to do with preventing change in the species, but when we consider the strong love exhibited by the Common Gannet for particular breeding grounds, they and their offspring returning to the place, year after year, to breed, in spite of, in many instances, constant persecution, mere wandering in winter can have very little effect upon them, as far as specific change is concerned, for the isolated colonies, both in the tropics and the north, must be subjected to much the same influences.

On the other hand, once let the birds become susceptible to change, either through physical degradation, or any other cause, then the very fact that the birds have a strong inherited attachment for a particular locality, becomes favorable to specific change, for isolation places them under the most favorable conditions to produce such a change.

(CONTINUED.)

PUBLICATIONS RECEIVED.

REPTILES AND BATRACHIANS FROM THE CAYMANS AND THE BAHAMAS. BY SAMUEL GARMAN. Authors extra from the Bulletin of the Essex Institute; Vol. XX; 1888.

In this paper are embodied the results of the collections made by me on my last trip, the specimens having been turned over to Prof. Garman for the museum of Comparative Zoology.

From Cayman Brac Prof. Garman finds six lizards and one snake. Three of the lizards are new species and the snake is given as a variety of Alsophis angulifer of Cuba. One lizard, Liocephalus carinatus, is Cuban and is also found on Andros, Bahamas, while the Iguana, already mentioned in this number, is more generally distributed. On Little Cayman, seven miles distant, only, from Cayman Brac, are two species of Anolis, one being the same as that found on Cayman Brac, and the other different and new. The Iguana also occurs here, as well as the common, West Indian, Hyla septentrionalis. The affinities of the species, not mentioned, are with those of Cuba and Jamaica.

From Inagua, out of three species of lizards collected, two are new. From Rum Key, out of three species of lizards, two are new, and one small lizard from Andros is new.

I had the pleasure, in company with Prof. Garman, of comparing his new species with their nearest allies, and can say that I fully endorse his opinions concerning them.

AN EEL, (RHINOMURÆNA QUÆSITA) FROM THE MARSHALL ISLANDS. By SAMUEL GARMAN. Author's extra from the Bulletin of the Essex Institute; Vol. XX; 1888.

Contains a description of a remarkable eel, with projecting, tubular nostrils, having the appearance of being slit on the lower side for about half their length, and with three barbules on the extremity of the lower jaw. The tail is also elongated. Prof. Garman not only considers it new, but has also placed it in a new sub-genus, as above given, on account of these peculiarities.

DESCRIPTION OF A NEW SUB-SPECIES OF POOCÆTES FROM OREGON; BY G. S. MILLER, JR. Author's extra, from the Auk for Jan., 1889.

Mr. Miller here gives a description of what is, at least, a perfectly valid sub-species, separating it from the Western Vesper Sparrow on account of the greater amount of ochraceous tinging, especially above, and smaller size. It is called Poocætes gramineus affinis, Oregon Vesper Sparrow.

ORNITHOLOGIST AND OÖLOGIST, VOL. XIII, 1888. Published by FRANK B. WEBSTER, BOSTON.

Through the persevering efforts of the publisher, this magazine has been pushed to the front ranks, and is now one of the leading exponents of ornithological literature in America. Its articles are well selected, and its corps of contributors among the best in the country. Among the very many interesting papers, over which one dwells with absorbing interest, and which are too numerous for me to mention in this place, I may say, that those from the magic pen of J. M. W. are worthy of the warmest commendations, representing, as they do, the very acme of raptorial oölogical lore.

DESCRIPTION OF SUPPOSED NEW BIRDS FROM WESTERN NORTH AMERICA AND MEXICO. BY WILLIAM BREWSTER. Author's edition, published in advance of the Auk for April, 1889.

Mr. Brewster has here described ten species and sub-species in his usual clear manner. One of the most note-worthy species is Dendroica nigrifrons, Black-fronted Warbler from Pinos Altos, Mexico, that is allied to Audubon's Warbler, but differs from it in having the forehead, sides of head, and a large patch on the breast, black.

NOTES AND CRITICISMS.

The unusually mild weather during the past winter, has in the vicinity of Boston, at least, had no apparent influence on the migration of such birds as pass south of us, for aside from the large flight of Kildeer Plover, early in the season, already recorded by others, I have seen or heard of nothing peculiar. On the other hand, there has been a noticeable dearth among the winter birds, and if any of the species have been seen at all, it has been in small numbers.

On the eighteenth of January, a very warm day, I encountered a Shrew, Blarina talpoides, that was wandering around, and about which I shall have quite a singular story to relate in the next Contributions.

While the appearance of the very many local lists of American Birds, which have appeared of late years, afford grounds for felicitation, one cannot avoid noticing among them, a matter that must impair their value to a greater or less extent. I refer to the growing tendency to record birds as occurring in a given section, upon too slight evidence. I will not here enlarge upon the various devices employed to secure a species, for swelling the numbers of a list, but turn at once, to the most noticeable evil which is that much too frequently, do we read "seen" instead of the legitimate "taken" or "shot".

Already this evil is made apparent in larger fields than mere local lists, for even the official catalogue of the American Ornithologists Union contains birds that are admitted upon objectionable grounds; few to be sure, but enough to establish a dangerous precedent and to make these errors too grave to be countenanced.

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Not only are the different colors, and form of wings, antennæ, etc., described, in a simple, thorough manner, with the use of but few technical terms, and measurements given of the several parts, but the species in hand is compared, under Observations, with allied species, and the salient points of difference noted, rendering the species at once recognizable.

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By Charles J. Maynard.

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Few, if any, among American Naturalists have had the wide experience with eggs that has been accorded to the author during the past thirty years. He has not only collected largely during this time, but in his former capacity as a dealer in eggs has had many thousands of specimens pass under his observation. Through handling such a vast amount of material, many minute points of difference, in various closely allied species, have been noted, and are recorded in the present work, rendering it peculiarly valuable.

The work throughout is thoroughly practical, and is intended to meet the wants of all, from the merest tryo to the professional naturalist, to aid in the identification of our eggs. That this object is being accomplished is rendered certain by the numerous highly commendatory letters and notices that have been received by the author.

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11. „ nana, „ „ „
16. „ nitela, „ „ „
8. „ copia, „ Cayman Brac.
9. „ parva, „ „ „
15. „ perplexa, „ „ „
13. „ ianthina, „ Inaugua.
17. „ alba, [provisional name] **from Rum Key.**
18. lentiginosa, [provisional name] **from Rum Key.**
19. „ cinerea, [provisional name] **from Andros.**
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The revision of the present edition of the Birds of Eastern North America is very complete, and differs from the former edition in the following particulars:

The entire work has been repaged, and the former order reversed, beginning with the Water Birds, thus giving them considerable more prominence.

Many species have been added, of which full descriptions are given, followed by an account of their habits, including time and place of breeding, migrating range, etc.

Much additional matter has been given pertaining to species already described; this is particularly true of the Aquatic species, and embodies the results of the studies of the author among these birds, while on several expeditions, made during the last ten years, in Florida, among the Bahamas and through the West Indies.

Many pages have been rewritten, and, altogether, more than one hundred pages of new matter have been added.

Eight more plates have been given, and about half of the old ones have been redrawn, while many figures have been placed in the text. All of the plates, and many figures are hand colored. The plates are all drawn on stone by the author.

In an appendix will be found a compendium of many species which have not been found within our limits, but which may occur, or which are of interest as being closely allied to those which do. Short, comparative, but sufficient, descriptions are given of these, and as especial attention is paid to the species, not included in the body of the work, that are found between the Mississippi River and the Rocky Mountains as well as in the Bahamas, the ground covered by the present edition is greatly extended.

It has been the author's aim in this work to give clear, comprehensive descriptions of every species that occurs within our limits, written in such a manner that they will be readily understood by everybody; while under the head of observations, the species in hand is compared with its nearest allies and the differences given.

The work is a large quarto, containing upwards of six hundred pages and forty hand colored plates. It is being issued in forty parts, each containing, at least, sixteen pages and one colored plate. Two parts, or more, are being published each month.

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OF THE

BUTTERFLIES OF NEW ENGLAND.

The first edition of the BUTTERFLIES OF NEW ENGLAND sold rapidly, rendering it necessary thus early to prepare another. This edition has not only been revised by the addition of copious notes, thus bringing the work up to date, but an appendix has been added in which are given descriptions of the species that occur near our borders that have not been taken within our limits, and are not included in the body of the book. The ground covered by the present edition is thus greatly extended, it being not only a treatise on the Butterflies of New England but also of the Middle States and Canada.

Two new plates accompany the appendix, on which are figured at least one surface of all the species described therein.

Altogether, the book contains ten plates on which are represented both surfaces of some one hundred and twenty-five species of Butterflies, making some two hundred and fifty figures. The plates are hand-colored from nature, thus well representing the insects that they are intended to portray.

The figures are drawn on stone by the author, the work being done with great care, and original descriptions are given in the text in such a manner that any one, even if not interested in the subject, can readily understand them. Not only are the different colors and form of wings, antennæ, etc., described in a simple, although very thorough manner, and several measurements given of these parts, but the species in hand is compared, under Observations, with allied species, and the salient points of difference noted, rendering each species at once recognizable. As few technical terms are used as possible, for it has ever been the author's aim to simplify science, rather than to mystify by using long and too often meaningless terms.

The work is a large quarto, uniform with the Birds of Eastern North America, and contains upward of one hundred pages of text, consisting of descriptions of species, explanation of plates, etc., etc. It is being issued in ten parts, each containing one colored plate and accompanying text. Two of these parts appear every month.

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8. " copia, " Cayman Brac.
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15. " perplexa, " " "
13. " ianthina, " Inaugua.
17. " alba, [provisional name] **from Rum Key.**
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A NEW WORK ON THE

EGGS OF NORTH AMERICAN BIRDS:

BY

CHARLES J. MAYNARD.

ILLUSTRATED WITH TEN HAND-COLORED PLATES.

The book begins with the descriptions of the eggs of the Water Birds, and the species are numbered as in the List of the American Ornithologists Union, the nomenclature being the same so far as it is there given, but every species and sub-species, that have been described up to date, are included, considerably augmenting that list.

All known eggs are described, and the description of each is given so clearly as to render it readily distinguishable; in case of rarities this is often accomplished by comparison with some well-known species, or with the figured type, of which there are eighty, contained in ten plates, carefully drawn on stone by the author, and accurately colored by hand by Mrs. Maynard.

The dimensions of the largest and smallest of a large series of the eggs of each species, number of eggs deposited, nesting time, breeding range, and description of nests are given. Few, if any, among American Oölogists have had the wide experience with eggs that has been accorded to the author during the past thirty years. He has not only collected largely during this time, but in his former capacity as a dealer, has had many thousands of specimens pass under his observation. Through handling such a vast amount of material, many minute points of difference, in various closely allied species, have been noted, and are recorded in the present work, rendering it peculiarly valuable. As few technical terms as possible are used, and thus the descriptions are at once available to all classes of students.

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BY

CHARLES J. MAYNARD.

ILLUSTRATED WITH HAND-COLORED PLATES, DRAWN ON STONE BY THE AUTHOR.

VOL. I. JULY, 1889. No. 2.

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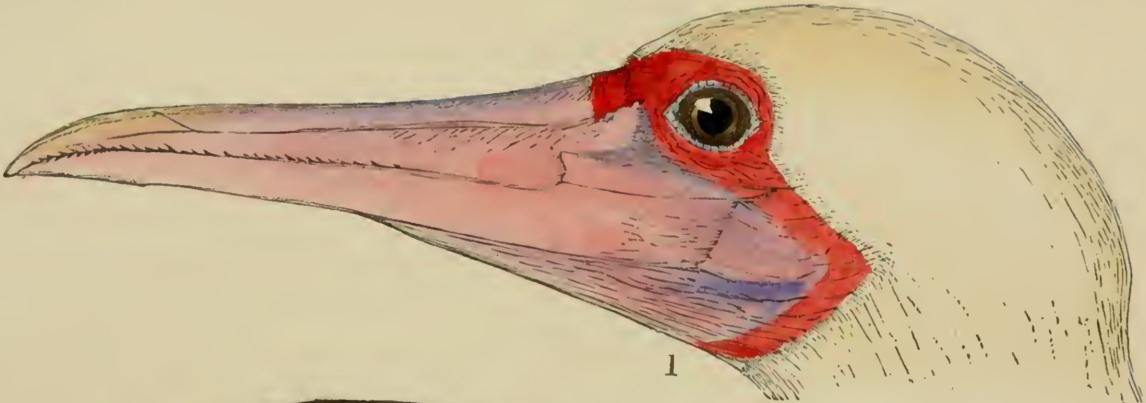
PLATE V



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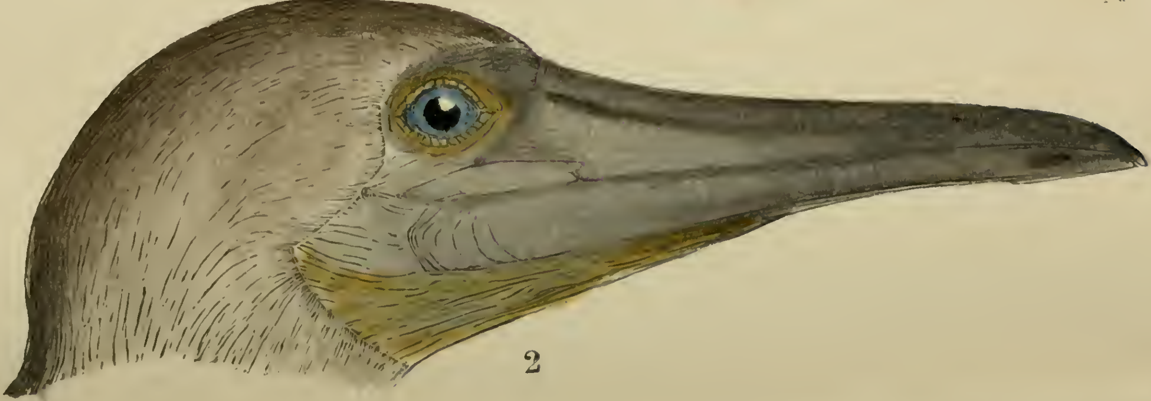

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C.J.M.

EXPLANATION OF FIGURES ON PLATE V.

1 Head of Cory's Gannet, Sula coryi, adult male in white phase of plumage; type.

2. Head of same species, young in first plumage, male. Both of the specimens were taken on Little Cayman, May 2d, 1888.

CONTRIBUTIONS TO SCIENCE.

BY

CHARLES J. MAYNARD.

Vol. I. July, 1889. No. 2.

DESCRIPTION OF A SUPPOSED NEW SPECIES OF GANNET.

(CONCLUDED FROM PAGE 48.)

Mr. Samuel Bodden of Cayman Brac, informed me, that the first eggs of Cory's Gannet are deposited by the first of January, and that by the middle of this month, the greater portion of birds which occupy the gannetry, are breeding. Individuals, however, continue to lay until the first of March; thus, although I did not find any fresh eggs, as I have already remarked, I did find eggs containing embryos. I also found the young in all stages of growth, from the newly hatched, naked specimen to the fully fledged birds that were flying as ably as their parents. I was thus afforded an excellent opportunity for observing the habits of the young in all these phases of developement.

I have related with what extreme care the egg is guarded by the parents; their solicitude for its safety, was so great as to overcome all fear of my approach. I could climb a tree on which a number of nests were placed, some of which contained birds that were incubating, without them taking flight; even when I was within arms length of them they would not move, but would sit perfectly quiet, regarding me with

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attention. When I stretched out my hand toward them they would not even attempt to escape, but would merely bow the head downward, nearly touching the breast. They uttered no sound at this time, neither did they evince any sign of hostility. I was so completely deceived by the amiable and dove-like behavior exhibited by the first bird that I encountered, that I unhesitatingly reached out my hand to feel beneath her in order to ascertain upon what she was sitting. She maintained her state of composure until my fingers were within a foot of her, when without a moment's warning, she launched out her bill fiercely, seizing my hand with a vice-like grip. Then she almost instantly jerked back her head without opening her bill, thus cutting my hand badly above and below, with the sharp, serrated edges of the mandibles.

I did not fail to profit by this hint, and ever after carried a short stick, then when I wished to find out what a Gannet had in its nest, would push the occupant off with this weapon, at which, however, the birds were too sensible to strike. When thus forced to vacate the nest, they would seldom fly, even when there was only an egg, and never, if there were a newly hatched young. They would, in these latter named cases, simply retreat a few feet along the limb on which their domicile was placed, then would return as soon as I removed my stick and bending down, would touch their helpless offspring with the tip of their bill, repeating this several times in succession, at the same time looking at me with a most piteous expression in their brown eyes, entreating me with every motion, more eloquently than words could have done, not to injure the object of their tender care.

When the young are fully clothed with down, which occurs in ten days, they are not so persistently covered, but are still carefully guarded by their parents, in fact, when they are as large as the old birds it is usual to find either the male or female sitting beside them, and at night both birds are there.

The young, in all stages of growth, are very fearless, and when I was ascending the trees, in order to examine the nests, I would often feel something tugging at my coat, and turning would see a young Gannet holding on, doing his best to impede my progress. Or one near which I was passing would reach out and catching my hat by the brim would pull it off, then drop it on the ground.

When in the down, the young Gannets are exceedingly playful, and a fine one that I carried to my house on the opposite side of the island, that was nearly, or quite, as large as the adults would play with small sticks by balancing them in his bill, and would then pile them nest fashion on the box on which he sat. Young birds in the gannetry would also often play with a noose that I always carried dangling from the end of a pole, in order to catch any bird that I wished to examine, whenever I put it within their reach.

The young of all sizes cling to the trees very tenaciously and the older nestlings climb well, aiding themselves with bill and feet, but the short, nearly rudimentary, wings are never used for this purpose, as they are evidently easily injured.

The newly hatched Gannets are fed at first by true regurgitation, that is the fish eaten by the parents is converted into a peculiar glairy fluid which is given to the young. The old birds introduce the terminal portion of the bill into the mouths of their offspring and the liquid is literally poured down their throats. Later the fish is given to the to the young in half digested fragments and in the same manner, then the size of the pieces is gradually increased, until finally whole fish are disgorged for them. In all cases the fish are swallowed by the adults and so carried to the gannetry.

The young remain in the nests until two thirds grown, then leave them and perch on the branches near. Here they remain until wholly fledged, and evidently for some time after. In fact, they appear to fly with considerable reluctance, sitting on the branches long after they are capable of using their wings. I have often taken such birds in my hands and by tossing them gently into air, induced them to take wing, and in all cases, when once launched, they would fly readily. frequently keeping in air for some time. On several occasions, I have seen the adult Gannets trying to compel their young to take wing, by flying against them in order to push them from the branch, the young remonstrating by struggling and screaming lustily, but the parent would invariably accomplish its object after a trial or two.

The cry of the young to the parents, when they desire food, is a kind of chatter, much like that emitted by young herons, under similar circumstances. When annoyed they will give a harsh squak and at the same time will launch out the bill at the intruder. As in all birds, there is a large amount of individual variation in respect to disposition; some being very irritable, and these would even attempt to reach me with their bills when I was walking along the ground; others were good natured from the beginning. Such would would even permit me to stroke and pet them as they sat in the trees or on the nests. The one that I kept at my house and that I afterwards carried to Kingston in company with a young Man-of-war, was very tame and soon learned to recognize me, evincing his enjoyment upon being petted by a tremulous motion of the head. Singularly a young Snake Bird, that I got in

Florida many years ago, and the adult White Pelican, Johnnie, that I kept in the north for four years, had a similar habit.

The adult Gannets give harsh cries when annoyed, and upon returning from a fishing excursion, just before alighting, they give a series of nearly continuous croaks. Both young and adults sleep by lying down upon whatever they may be perching, often with the head hanging directly downward, the neck stretched at full length. So singular is this attitude, that the first time I saw an adult in this position, I was so sure that it was dying, that I went to it and caught hold of the head, before it was aware of my presence; the result was a surprise for both of us, the Gannet recovering with such marvelous celerity, as to astonish me, and it, in turn, retreated screaming, badly frightened at this unceremonious awakening.

One hears the cries of Cory's Gannet very frequently, when they are annoyed by the Man-of-wars which rob them most persistently as they come in from fishing. In returning from their fishing excursions, the Gannets invariably come on to the land directly opposite the gannetry, often skirting around the key, in order to do this. The Man-of-wars are aware of this habit, and as they breed on the margin of the mangrove swamp, often placing their nests on the same tree with the Gannets, they are always in waiting, scores cruising up and down in mid air, along the bay on which the gannetry was situated. The Gannets return in small flocks, varying from three or four to twenty, and they are allowed to approach within a quarter of a mile of the shore, when the enemy sallies out to meet them. Sometimes only two Man-of-wars will go, but oftener eight or ten will band together and make a rush at the Gannets. The object of the aggressers, is to separate a Gannet from the flock, and this is usually accomplished, The poor bird is at once surrounded and harassed by loud cries and buffetings, two or three Man-of-wars frequently seizing it by the tail or wings. When thus surrounded, the persecuted Gannet has only two alternatives, either to drop upon the water, where the Man-of-wars at once leave it, or to disgorge its fish. The falling fish is either taken in the air, before it gets to the water, by one of the pursuers, or is picked up before it has time to sink. It sometimes happens that the Gannet will only give up one of its fish, hoping to escape while its persecutors are after its prey and gain a point over the land, where it is seldom molested, especially if flying low, as the Man-of-wars cannot pick up the fish from the ground. In case only one fish is dropped the piratical birds perceive at once that they are being deprived of a part of their booty, and quickly continue the pursuit. They evidently demand all the Gannet has to spare for its young, for a bird robbed of both fishes, at once turns and flies out to sea again for more.

I say it is rare for the Man-of-wars to pursue a Gannet over the land, but I saw one so pursued, on one occasion, and it was so hard pressed that it fell upon the ground. It is impossible for a Gannet to gain wing from the ground, and they usually scramble along with the aid of wings and feet, until they reach some bushes, into which they climb and from the top of which they launch out.

The instinct for avoiding all land, excepting the section occupied by the breeding ground and the space immediately in front of it, between it and the water, is most peculiar, inasmuch as it submits the Gannets to much persecution from the Man-of-wars that might be avoided. Thus Gannets returning from fishing on the north side of the island, flying as they often do, at the height of a thousand feet, must see the gannetry on the south side, long before they reach the border of the land opposite it. In fact they probably do see it, for I have frequently observed them, especially at night when companies are returning to roost, come nearly over the shore in front of my house, which stood nearly opposite the breeding ground, when one, evidently the leader of the party, would give a cry and dart away from the land, often flying a quarter of a mile to sea, instantly followed by the others. Then all would skirt the key around the west end, to the gannetry, and thus run the gantlet of the cordon of Man-of-wars, when they could have crossed the mile of country between the shore and the gannetry, in a few moments, and not have been disturbed at all by their enemies. In passing to and from their fishing grounds,which are always in blue water, the Gannets fly in long lines, or more rarely in wedges, something after the manner of our Wild Goose, but the lines are not maintained as perfectly as in that species.

Cory's Gannets are very peaceable birds. seldom quarrelling among themselves; in fact, I never saw them even attempt to attack the Man-of-wars that were breeding in the margin of the swamp, with their nests often on the same tree with those of the Gannets. The young of both species appear to live on perfectly good terms, and two that I had became quite attached to one another.

DESCRIPTION OF NESTS AND EGGS.

NESTS, placed in trees or bushes, composed of sticks loosely arranged like those of Herons, flat on top and about twelve inches wide.

EGGS, one in number, oval, yellowish-green in color, covered with a white calcareous deposit. Dimensions, from 1.50 x 2.30 to 1.65 x 2.30.

CONCLUDING REMARKS.

Since writing the description of Cory's Gannet, I have concluded that what I have there called, "Young in 2d and 3d years." is really an adult dress, and that this species of Gannet assumes two phases of coloration as a final plumage.

This hypothesis is based on the following grounds:–

First; a very large number of species in the gannetry at Little Cayman, were in this dress, and in no instance did I find any gradation between the white-tailed brown birds and the white plumage.

Second; I find, upon a careful examination of the under plumage of the skins now in my possession, that the new feathers are just budding, and that on the anterior (now brown) portions of the birds, the brown plumage is, in every case, going to be repeated.

In short, this Gannet, like S. bassana, passes at once from the first brown plumage into the final adult phase, without any usual intermediate, "off" plumages occasionally assumed, as in the rare mottled dress of S bassana, being the only exception to the rule. The plumage that I have characterized as "Younger" in the description, is an "off" plumage. Undoubtedly this is worn through life, as my specimens were moulting into the same dress.

When I visited Bird Rock, Gulf of St. Lawrence, in 1873, I estimated that there were, at least, 20,000 Common Gannets breeding on the Great and Little Bird; out of this immense number, I did not see more than twenty mottled Gannets, and I may say, that during the ten days that I spent on the rock, I saw very nearly every Gannet that was breeding on both rocks. Thus the "off" plumage in this species is very rare, and is but little more common in Sula coryi. Cory's Gannet will have two styles of "off" plumage, one for the brown dress and one for the white. See remarks upon this plumage being a tendency toward reversion, in the article in this number of Contributions, under head of Probable Evolution of the Totipalmates.

To show the material that I have handled and examined, in deciding upon the specific rank of Cory's Gannet, I will here give a summary of the facts, some of which are already mentioned.

In the gannetry at Little Cayman, were breeding, at least, 10,000 of this species. The trees on which they were nesting, were low, and birds were tame, so tame that I could take them up with my hands when within reach, or if not, I could secure any particular bird, with a noose on a pole which I constantly carried.

I spent many hours in the place, and it is safe to say that I examned half the birds in the gannetry, at least, casually, and, as follows, very minutely for particular points mentioned; I am therefore thoroughly convinced that my conclusions are correct.

Of adult white birds, I have either handled or seen at a distance, varying from arms length to not more then five feet, 1,000 specimens, and not one of them had any brown on the tail.

Of adult brown birds having white tails, I have examined, under the same conditions, at least 1,000, and with one exception, which specimen I now have, I did not find a single brown tail among these. The one with the brown tail is an example of the "off" plumage of the brown phase.

SINGULAR EFFECTS PRODUCED BY THE BITE OF A SHORT-TAILED SHREW, BLARINA BREVICAUDA.

On the eighteenth of January, a remarkably fine day, even for the warm winter of this year, (1889) I was walking across the farm with my dogs, when my attention was attracted by the barking of one of them. Going toward her, I found that a shrew was the cause of the noise. The dog had thrown it up in the air once or twice, and as I came up, it lay on its back, endeavoring to regain its feet. I noticed that the old dog was quite cautious in approaching the animal, and the younger dog would not touch it at all.

I walked up to the prostrate shrew, before it could right itself, and picked it up in my hand. It nestled down snugly at first and lay perfectly quiet, but upon my presenting my hand to one of the dogs, to smell of the shrew in it, the little animal became aroused, and after making an effort or two, to escape, it fastened upon my hand with its teeth. At first the points of the teeth did not penetrate the skin, but after giving a pinch or two, it did succeed in making four small punctures. These wounds were on the left hand, near the base of the second finger, and as I moved my fingers to make the shrew loosen its hold, it let go and bit the finger just below the first joint. I then changed it over into my right hand, when it fastened on that also, making four small, or minute punctures at the base of the second finger.

All this occupied perhaps thirty seconds, when I began to experience a burning sensation in the first two bites, followed by a similar sensation in that on the right hand. I walked to the house, only a few hundred yards away, but by this time, the pain which had been rapidly increasing, had become quite severe, and by the time I had placed the shrew in an improvised cage, I was suffering acutely.

The burning sensation, first observed, predominated in the immediate vicinity of the wounds, but was now greatly intensified, accompanied by shooting pains, radiating out in all directions from the punctures but more especially running along the arm, and in half an hour, they had reached as high as the elbow. All this time, the parts in the immediate vicinity of the wounds, were swelling, and around the punctures the flesh had become whitish.

I bathed the wounds in alcohol and in a kind of liniment, but with little effect. The pain and swelling reached its maximum developement in about an hour, but I could not use my left hand without suffering great pain for three days, nor did the swelling abate much before that time. At its greatest developement, the swelling on the left hand caused that member to be nearly twice its ordinary thickness at the wound, but appeared to be confined to the immediate vicinity of the bites, and was not as prominent on the right hand; in fact, the first wound given was by far the most severe.

The burning sensation disappeared that night, but the shooting pains were felt, with less and less severity, upon exertion of the hand, from the elbow downward, for a week, and did not entirely disappear until the total abatement of the swelling, which occurred in about a fortnight.

Most unquestionably, the wounds inflicted by that shrew were poisoned in some manner, for they were all very slight, not penetrating the skin deep enough to cause any flow of blood, a mere staining being all that was perceptible, only enough to indicate that the skin was broken. Not over a month before this occurrence, I was attacked by the pet gray squirrel of a friend, and it bit my finger quite to the bone, but I did not suffer any particular pain nor inconvenience from the wound, and on the day that the shrew bit my hands, I scratched one of my fingers quite badly and the wound healed at once, so that my blood was not in a poor condition.

Now I do not wish to conjure up another bugaboo out of what may be a harmless animal, for our innoxious reptiles and batrachians furnish an abundance of these, yet I cannot well avoid giving a word of warning. Undoubtedly the shrew that bit me, was as poisonous as a rattlesnake in proportion to its size, and had it inflicted a wound on the the tender skin of a child this would have proved serious. Unfortunately the shrew escaped after being in captivity a few hours, so that the opportunity of dissecting it was lost, and I have not since found another.

It is a well known fact that an enraged animal, even a man is capable of inflicting a poisonous wound, and this may be the case in the present instance. But then my old dog Spot, who has taken two trips to Florida with me, and who has had a wide experience with many animals, is rarely afraid of anything. I have seen her attack water moccasins with less hesitation than she displayed when barking at that little shrew; in fact, she bears the scars of the fangs of two moccasins which struck her when she was attacking them.

THE VOCAL ORGANS OF THE AMERICAN BITTERN, BOTAURUS LENTIGINOSUS.

Dedicated to Bradford Torrey.

For over a hundred years, writers who have noticed the peculiar notes of the American Bittern, have propounded various theories regarding the probable method by which these sounds are produced. Some of these theories were apparently absurd; for example, we find it stated that the bird thrusts its beak beneath the water and thus bubbles out the sound; again, we are told that the bird beats either the water or a stake with its wings; none, however, came near the truth. It remained for Mr. Bradford Torrey and his friend, Prof. Walter Faxon, after watching a Bittern which was repeatedly uttering its notes, under peculiarly favorable circumstances, in the spring of 1888, to advance an hypothesis of the method by which the sounds are produced which is substantially correct. A most interesting account of this has been published by Mr. Torrey in the Auk for Jan., 1889.

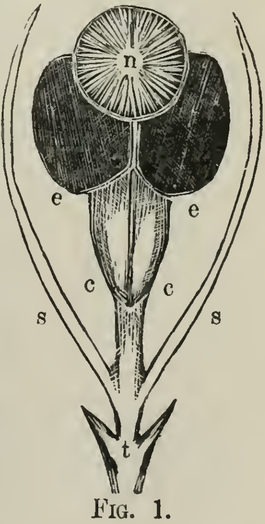


Fig. 1.

Briefly stated, Mr. Torrey's theory is, that the Bittern draws air into its œsophagus, thus inflating it, then somehow by this peculiar method produces the singular pumping sound.

When this paper of Mr. Torrey's first came to my notice, I may frankly state, that, although greatly impressed with the careful manner in which he made his observations, I believed he was mistaken in his conclusions, for I was sure that the pumping sounds of the Bittern had their origin in the inferior larynx, as is the case with the notes of all other birds of which we have knowledge. After dissecting, as will be seen further on, probably, the identical Bittern from which Mr. Torrey made his notes, I met with such strong, although totally unexpected and unprecedented evidence, of the general correctness of his theory, (that the notes proceed from the œsophagus) that I have with pleasure dedicated this article, wherein I have recorded what I consider one of the most important discoveries in ornithological anatomy that it has been my lot to make, to Mr. Torrey, as a slight mark of my appreciation of the excellence of his powers of observation.

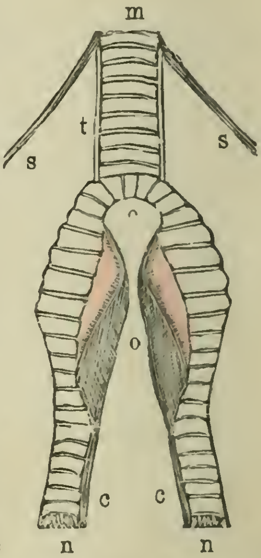


Fig. 2.

Although I had several times dissected specimens of the Bittern, during the fall and winter, I had never chanced to observe the vocal muscles in spring, and in order to settle the question as to the method by which the sound is produced, beyond dispute, I knew that it was quite necessary to procure a bird while in full possession of its vocal powers. Accordingly I visited the Wayland marshes on the 13th of last May, in company with my friend, Mr C. W. Chamberlain. We pushed our boat up the West Brook, and although we saw two Bitterns in the morning, was unable to secure one. About three o'clock in the afternoon, as we were returning, I heard the note of a Bittern, coming from the vicinity of the railroad bridge. The sound was only given two or three times, then ceased. In about ten minutes, the bird pumped again, uttering, as before, a few notes, then remained quiet a short time. During the intervals of the cessation of sound, we advanced toward the point from which it appeared to come, and after hearing the notes repeated about half a dozen times, managed to locate the bird at a point between us and the bridge. Assured that the Bittern was within reach of shot, I stepped on to the marsh, walked a few steps, when up it got and I easily killed it.

Now as this was quite near the place where Mr. Torrey observed his Bittern, the previous year, it is highly probable that I, by a singular chance, secured the very Bittern that gave rise to the article in the Auk. In fact, Mr. Torrey has since written me that he thinks this is the case, EXPLANATION.

a, eye.

b, first valvular, or mandibular, vocal muscle.

c, occipital vocal muscle.

d, space occupied by first bubble of air ejected.

e, ear.

g, tongue.

p, maxillary vocal muscle.

o, thoracic vocal muscle.

q, muscle of tongue.

r, vertebræ and six tendons supporting the œsophagul vocal muscle.

h, retractor muscle to upper larynx.

t, scapular attachment of the œsophagul muscle.

n, trachea.

i, inferior larynx.

k, sterno tracheal muscle.

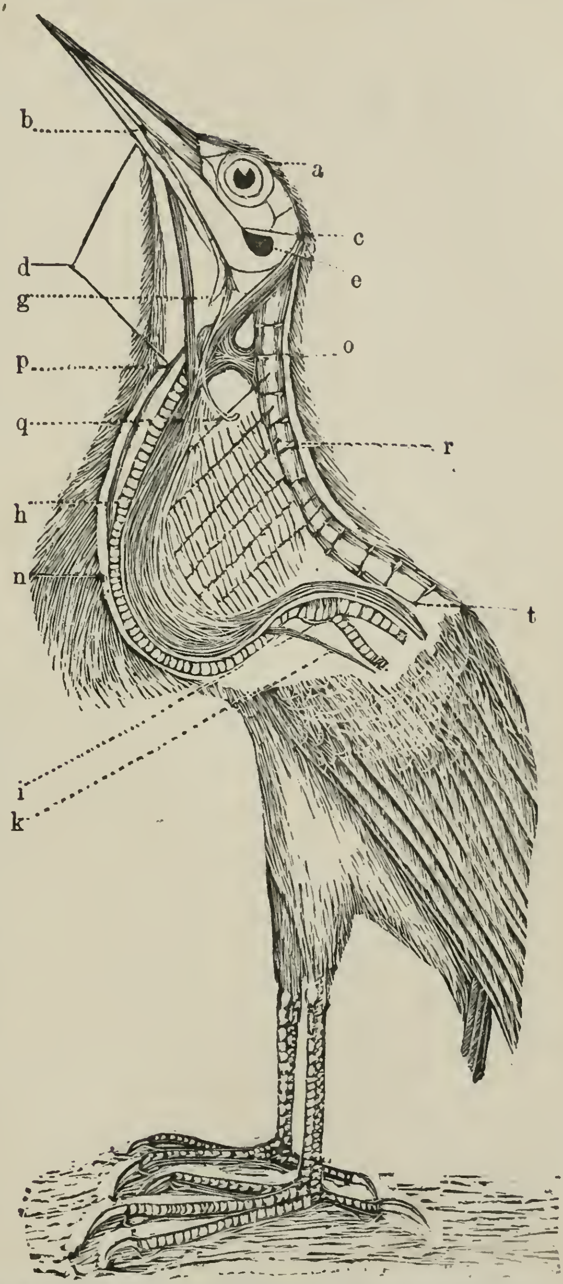


FIG. 3. IDEAL SECTION OF BITTERN, SHOWING VOCAL APPARATUS.

as he has observed the bird there this season. Although I much regret having been obliged to sacrifice Mr. Torrey's pet Bittern, the call of Science was so imperative, that I think the end has justified the means in this instance. If the manes of this particular Bittern are at all irate, that any act of mine has hurried his flight across that river which is wider, darker, and more mysterious than either the Sudbury or the Concord, it ought to be appeased by the satisfaction of having been the bird that has given origin to two quite lengthy articles. Then again, it has given me considerable satisfaction to have worked upon the very Bittern whose punk-a-pogs, through Mr. Torrey's efforts, have been heard around the world, for the results of my labors seem much more conclusive.

The most noticeable external peculiarity about this Bittern, is the greatly thickened skin of the neck. This thickening extends all around, but is especially developed from the lower portion of the black stripe, downward, where by its own weight, it hangs in a baggy manner some distance from the neck. Owing to this distention, there is a narrow naked space formed in front, that extends from the lower throat, downward. This is about .75 wide and provided with a little scattering down, is grass green in color, while the usual naked portion of the neck above, is bluish pink. The exposed skin of the face is bluish or livid, with a band of dark brown extending from the eye to the base of the upper mandible. The iris is yellow margined with reddish orange.

Upon inserting a tube into the mouth, I find that the œsophagus can be greatly distended, insomuch so that it measures, at least, seven inches at the base externally. Upon opening the skin on the back of the neck, I found a mass of air bubbles lying between it and the vertebral muscles. These air cells are enclosed in tissue and resemble those seen in the Pelicans, but are larger. Their function, in this case, is evidently to protect the neck from undue pressure, which would otherwise be caused by the inflated gullet.

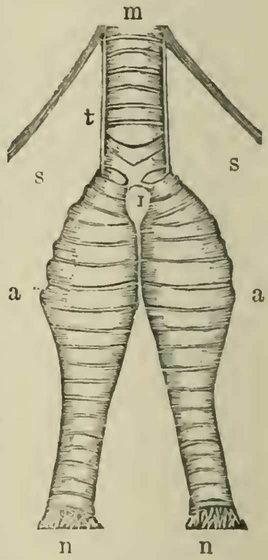
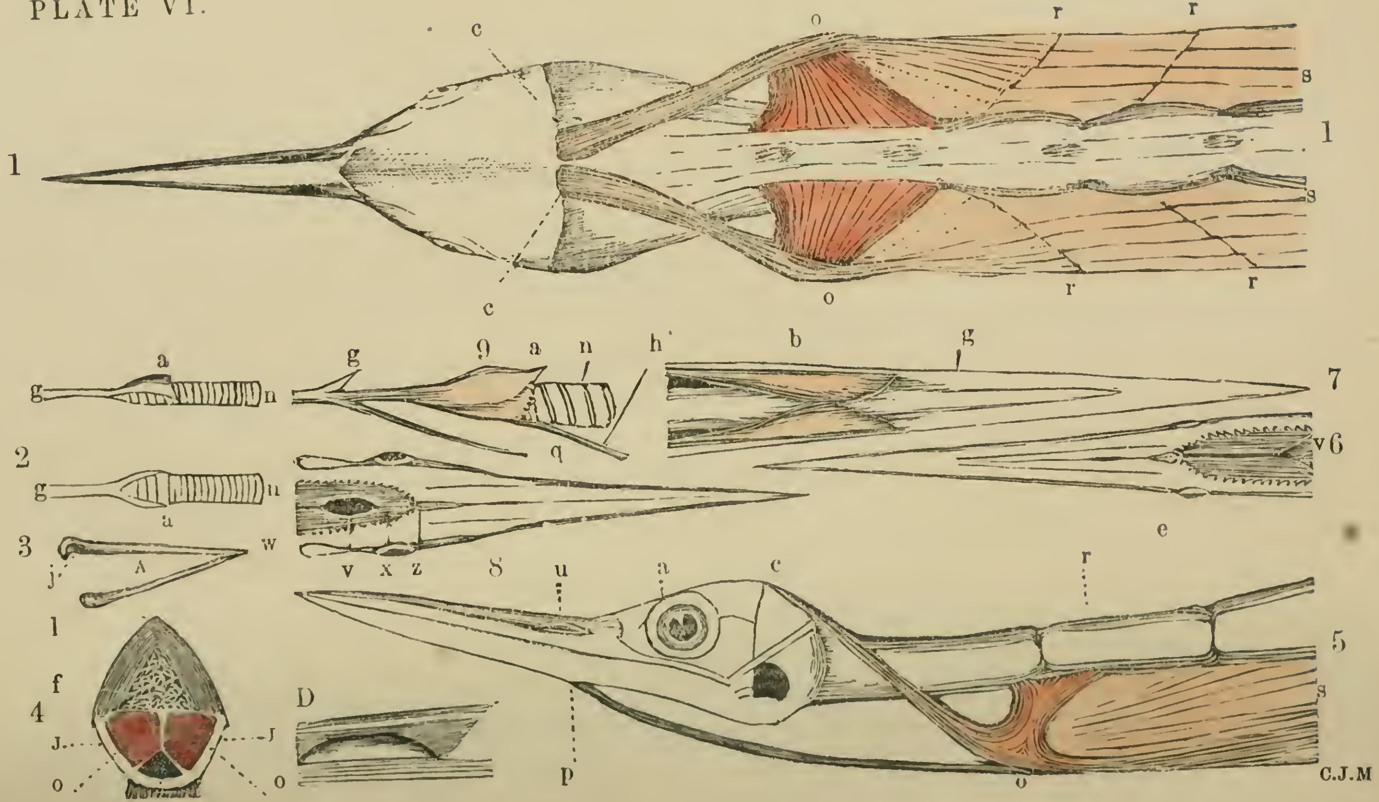


FIG. 4.

The gullet, independent of the muscles which surround it and the skin, is, when inflated to its greatest capacity, flattened above and puffed out on the sides and below, especially at the base. In form, it is narrowest near the mouth, becomes gradually enlarged as it proceeds

PLATE VI.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EXPLANATION OF FIGURES ON PLATE VI.

1. Upper portion of head and vocal muscles of American Bittern, one half life size; c, occipital vocal muscle; o o, thoracic vocal muscles; r r r r, tendons supporting œsophagul vocal muscles, s s. The vocal muscles in all of the figures are deeper in color than the others.

2. Upper larynx of Least Bittern, life size; upper fig . side view, lower fig., from below; a, larynx; g, tongue; n, trachea.

3. Closing valve to anterior nasal opening in upper portion of the mouth of American Bittern, twice life size; j, concavity in the elongated side into which the convexity on the opposite, shorter side fits; a, opening; w, hing angle.

4. Section through bill and mandibular vocal muscle of American Bittern. twice life size; l, upper mandible; f, the bone of same; j j, lower mandible; o o; mandibular muscles with tongue below them.

5. Side view of vocal muscles in American Bittern, one half life size; a, eye; p, maxillary vocal muscle; u, nostril; D, life size of same; other letters same as in 1.

6. Upper portion of mouth of Least Bittern, life size; e, closed anterior nasal opening; v, termination of posterior nasal opening,

7. Portion of the lower mandible of American Bittern, life size; g, tongue; b, mandibular vocal muscle.

8. Upper portion of mouth of American Bittern, one half life size, z, anterior nasal opening; x, closed space between anterior and posterior opening, v.

9. Upper larynx of American Bittern one half life size; h, retractor muscle; q, tongue muscle; other letters as in 2.

downward, then contracts quite suddenly at the base of the neck. It is about 9.00 inches long, 4.00 wide, and 6.00 deep.

The muscles that surround the œsophagus, are thin and separated from the skin by a layer of gelatinous or watery tissue which is so intimately connected with the skin of the neck, as to be inseparable from it. This watery tissue is filled with large, rather isolated, blood vessels, and the striped muscular fiber beneath it, is surcharged with blood. Indeed, the whole surface of the neck resembles skin that has been bruised and is evidently in a feverish condition.

These muscles which I have called œsophagui vocal, are separated along the neck above by a space about .50 wide, but below, the division is not as apparent, as the two lie directly together. Each muscle extends the entire length of the œsophagus, or rather of the inflatable portion of it, and is about 9.00 inches long by 4.00 broad; they attain their greatest thickness near the lower base, being .20 with the watery matter. The muscles are about the same width for three fourths their length, from the base upward, but narrow above, and on the upper margin become considerably thickened and send off a spur, the occipital vocal, on either side, which adhering to the crest of the bone of the back of the skull, above all of the neck muscles, act as retractors. These occipitals are .20 wide by some 2.00 long, but are thin. See plate VI, 1, c c, where I have represented the upper side of a Bittern's head, one half life size, and ib. 5, where a side view of the same is given, s, being the upper portion of the compressing muscle. Also see Fig. 3, page 61, where an ideal section of a pumping Bittern is given, the lettering being the same as above.

On the lower portion of the upper margin of each enveloping muscle, another spur arises, which proceeding upward, adheres to the lower portion of the bill, directly beneath the nostrils, Plate VI, 5, p o, and Fig. 3, page 61, p. This is also a retractor and supporting muscle.

On the lower margin of each enveloping muscle, near the base of the neck, is a narrow spur, or rather, a prolongation of the muscle, .50 wide by 2.00 long, but thin, Fig. 3, page 61, t. This is attached to the muscles in the scapular regions, and sends a branch across the back to meet its fellow on the opposite side.

These three accessory muscles, support the enveloping muscle, and aid in contracting it. Another function of the scapular attachment is to act as a kind of sphincter, to cut off the air in the gullet and prevent it from entering the proventriculus and stomach. The function of all the muscles thus far mentioned, is to force the enclosed air out of the expanded gullet.

For retaining the enclosed air in the gullet, there is a most singular arrangement. Lying on either side of the neck, attached partly to the first and partly to the second neck joints, is a short, thick muscle, the thoracic, to the lower side of which is attached the occipital. See Plate VI, 1 and 5 and Fig. 3 page 61, o. This peculiar muscle is 1.20 long, .90 wide, and .45 thick. It arises well under the neck, and when swollen by contraction, bulges out and meets its fellow opposite, and these, with the upper larynx, which lies beneath them, and a little behind, but which can be firmly pressed against them, completely obstruct the passage to the gullet. This arrangement can be better understood by referring to Fig. 1, page 59, where I have given a section, life size, through the neck and thoracic muscles; n, neck; e c, thoracic vocal muscles; c c, upper larynx. t, tongue; s s, tongue muscles.

These obstructions, or valves, of the gullet are opened by drawing the thoracic muscle upward and sideways and by drawing the larynx downward and backward. This latter named operation is accomplished by the aid of a retractor which has its origin on the lower portion of the larynx, and then extending downward, adheres to the lower portion of the œsophagul muscle; see Fig. 3, page 61 and Plate VI, 9, h.

Nor does this complicated arrangement for producing sound end here; lying in the lower mandible, on either side, adhering to the jaws just beneath the nostrils, are two muscles. These mandibular muscles are about 1.20 long, and each gradually becomes enlarged toward the anterior portion until it comes in contact with its fellow opposite; see Plate VI, 7, b, where a life sized figure of the interior of the terminal two thirds of the lower mandible is given; beneath these muscles, which also play the part of valves, is slipped the tongue, ib., g, and thus by pressing upward crowds the muscles against the roof of the upper mandible, completely obstructing the passage from the entrance of the gullet, to the tip of the bill.

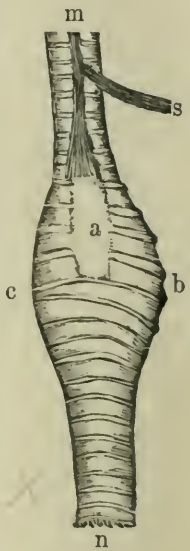


Fig. 5.

This mandibular valve can be seen in section, on Plate VI, 4, where a figure twice life size is given: l, upper mandible; f, bone of same; J J, lower mandible; o o, mandibular muscle, beneath which is the tongue.

The nasal opening in the interior of the upper portion of the mouth is peculiar and seems to indicate that the air is taken into the gullet through the nostrils. The anterior nasal opening is closed as in many species of birds, with a valve shown on Plate VI, 3, where is given a figure twice life size. One side is longer than the other, and at the base, that is nearest the gullet, is a concavity, j, into which the convexity on the opposite side fits. A, is the opening, and w, the hinge angle. Between this valve and the posterior, permanently open, nasal entrance is a space that is closed; ib. 8, where a figure of the upper portion of the mouth of the Bittern, half life size, is given; z is the anterior valvular opening, closed, v, the permanently open posterior entrance that comes within the mouth of the gullet, the lower edge of which is brought up against the intervening closed space, ib. x, thus preventing the escape of the air. The external nostrils ib. 5, u, are furnished with large coverings which act as valves; a life size view of one of these is given at D below.

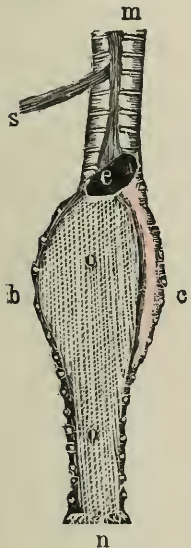


Fig. 6

The Least Bittern, which has no need of such an arrangement, has no closed interspace between the two nasal openings; Plate VI, 6, where is given a life size figure of the upper portion of the mouth of this species. Over e is the anterior nasal opening, back of which, terminating at v, is the continuous posterior opening.

In order to prevent the air from entering the windpipe, over which it passes to reach the gullet, the valves of the larynx are guarded with extra strong muscles which serve to close it. Compare ib. 9, upper larynx of American Bittern, one half life size, with that of the Least Bittern ib. 2, life size, upper fig. side view, lower, as seen from below; a is the larynx with the muscles; g, tongue; n, trachea, in all the figures. The muscles of the larynx of the larger species completely envelope the end of the trachea, whereas in the smaller species, they merely cover the top and sides.

Now having mentioned all the parts which make up the sound producing organs, I will proceed to explain how they are used and how, by their aid, the booming of the Bittern is accomplished.

The air is evidently drawn into the gullet through the nostrils as already explained, the bill being closed during this process. The nostrils are closed when a portion of air is introduced sufficiently large to swallow, and as this cannot escape, at least beyond the mandibular valve, Fig. 3, Page 61, b, it is readily taken into the gullet, by the simple act of gulping it down. The gullet, or œsophagul receptacle, once full of air, during which operation, according to Mr. Torrey's observations, the bird goes through some very strange contortions, our musician is ready to utter his melodious song, or rather what answers for such.

The muscles that act upon the inflated gullet now compress it, the valves at ib. o, are opened and a bubble of air is admitted into the space between the two sets of valves, indicated by the diverging lines at ib. d being stopped at the mandibular muscles, ib. b. This is the first note, " punk ", a few seconds intervene and then the mouth is opened and the air within it is released, or forced out by another bubble behind it, coming from the air reservoir, and we have two syllables, nearly together, " a-pog " the whole rendering, to my ears, being, " punk-a-pog " with a peculiar watery intonation that must be heard to be thoroughly understood.

I presume that there is considerable individual variation in the notes, as among other birds; that is, no two Bitterns sing exactly alike. Varying distances will also cause the notes to sound differently; intervening objects, like woods or hills will obstruct the cadence and will cause it to vary; then again, it is difficult to find two persons who will exactly agree as to the expression of bird notes, these sounds evidently not producing the same impression upon one as upon another.

With all this, however, I have little to do at present, and my story of one of the most clumsy, ill-contrived arrangements for producing sound, that was ever possessed by any living animal, is nearly told. I may say that no anatomist, even in his wildest dreams would ever have conceived such a scheme! Indeed, the whole system is so utterly without precedent among birds that have come under my observation, that had I not been absolutely forced to believe that the notes of the American Bittern were produced by this most singular muscular arrangement, which evidently assume these peculiar functions for a short time only, by having it exhibited to me so clearly that there is no room for doubt, I never could have given it credit.

When Mr Torrey compared the voice of the Bittern to the sound produced by a pump, his simile was not far from correct; the vocal apparatus of this bird is like a pump with two boxes. Mr. Torrey is rather inclined to think the sounds are made by the act of inhaling air, but Prof. Faxon more correctly thinks the sounds are made by exhalation.

After examining the vocal organs described, with the results indicated, I was not surprised, upon looking at the inferior larynx, to find that the usual sound producing apparatus here was nearly functionless, and evidently only used to give utterance to the harsh note that the

Bittern emits at times, upon rising when disturbed. The sterno tracheal muscle, Figs. 2, 4, 5, 6, s and Fig. 3, k, that acts as a retractor for the vibrating, or tympaniform, membrane, is not particularly well developed. The tympaniform membrane, Figs. 2 and 5, o, although broad, is thick and incapable of much vibration, and finally, the bones which make up the body of the larynx, Fig. 2, e, and Fig. 4, I, are short and on the sides, are fused together as seen in Fig. 5, a. I have given figures of the lower larynx, to show a peculiar modification for preventing too great pressure against the inside of the bronchial tubes, by the distended lower portion of the gullet which passes between them. Although the air is cut off, in a great measure, from this portion, by the scapular attachment of the large compressing muscle, Fig. 3, t, yet there must be considerable inflation of this part. As seen in Fig. 4, a a, the bronchial tubes are considerably widened, even on the upper side, and below, their width is no less. On the under side of each tube, there is a swollen portion made up of a hard, rather fibrous substance. This is the portion colored pink in Figs. 2 and 6. This elevated portion comes in contact with the gullet and prevents it from pressing against the tympaniform membrane. Fig. 2 shows the lower side of the larynx, 4 the upper side, 6 is the inside of the left bronchial tube, the right side being removed at this junction with the trachea, e. Fig. 5 shows the outside of the same tube. All the figures are the size of life. Other references not given, are as follows: m, trachea; t, beginning of slight bronchial muscle, best seen in Fig. 5, between m and a; c, bronchial tubes; and n, position of lungs.

SUMMARY.

I give below a summary of the various modifications that the organs of the American Bittern have undergone in order to produce the pumping notes. I do not wish to be understood to say, that the different muscles given are positively new to science, but that the functions to which they are here applied, have never been noticed, and that they have become so modified in order to perform these functions, as to warrant the applications which I have given them. I have never noticed anything of the kind among other Herons, and a pair of Least Bitterns, Ardetta exilis, taken at Wayland, June 10th of this year, did not, upon careful examination, show even a rudiment of the peculiar vocal muscles, and they were about to breed.

1. The œsophagul, enveloping muscles assume peculiar characters for the breeding season. They weighed, with the skin, six ounces. May be present in other species, for the purpose of shaking the skin of the

neck; for example, the constrictor colli of Owen, seen in the Apteryx, may be something similar.

2. The scapular prolongation of the œsophagul muscle has an analogy to the muscle that assists to empty the crop in Pigeons and in some other birds, but they have a different attachment; viz. to the inside of the coracoid bones.

3. The occipital vocal. I have never seen described anything just like this muscle, neither have I found it in other birds. A Cochinchina fowl had a flat muscle starting below the ear and just in front of it, and extending back some two inches, to be inserted on the skin of the neck, its use evidently being to raise the feathers of the neck.

4. The maxillary vocal; I have never seen anything like this muscle.

5. The thoracic is a most peculiar muscle at this time, being surcharged with blood and evidently temporarily greatly enlarged.

6. The mandibular vocal are also singular muscles, surcharged with blood and evidently enlarged for the occasion. I am under the impression that I have seen these muscles either in this species before or in some other Heron, but I do not appear to have made a note of it.

7. The retractor to the superior larynx is not present in the Least Bittern, nor in most birds; I found it, however in a Cochinchina fowl, but in this case it extended to the body, and was attached to the lower portion of the termination of the furcula.

The inferior laryngeal modifications and the bubbles in the tissue to prevent undue pressure, the one on the neck and the other on the bronchials, together with the crop-supporting tendons of the neck, appear to be common modifications, arising with requisite circumstances.

MONOGRAPH OF THE GENUS STROPHIA.

(CONTINUED FROM PAGE 29.)

Since writing the first part of this monograph I have seen additional collections, and must say, that I am more than ever impressed with the fact that the genus Strophia needs a thorough revision. I am impelled to form this opinion after noting the doubtful manner in which some collections are labelled. Not only are the most obviously different species, from widely different localities, labelled with the same name, but many names are supplemented with a "?", or with "var.?"!

13. STROPHIA IANTHINA Novo.

Violaceous Strophia.

Plate II, 13 & 13A, shell.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, rather heavy and elongated, the width being about one third the length. Striations, present. Teeth, two, both short and not prominent. Whirls, 11. Examined 300 specimens.

Form of shell, cylindrical, the first three whirls being nearly equal in diameter and occupy more than two thirds of the length of the shell. The fourth whirl is but slightly smaller and from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The striations are numerous, 24 on the upper whirl; they are prominent, very regular, and arranged in lines which are quite straight, being very little inclined from right to left; and the interspaces are little wider than the prominences. The striations are not furrowed and the edges are smooth and rounded.

Aperture, very large and open, measuring considerably more just within than at the entrance. Lower tooth very small, .02 high and .08 long, placed about in the centre, and the upper tooth is but a mere rudiment.

Margin, not produced forward beyond the diameter of the shell, slightly inclined to the right, is thin, with the edge rolled well back, about once the thickness of the margin. The frontal bar is well developed and the striations appear within elevated.

Color of shell externally, deep violaceous purple, gradually becoming reddish orange toward the apex which is nearly white. The margin, frontal bar and striations are white, the latter somewhat encroached upon, especially above, by violaceous. Internally, very deep, rich purplish brown.

DIMENSIONS.

Size of types; 1.15 by .37 and 1.00 by .36. Largest specimen, 1.15 by .42; smallest, .85 by .30. Greatest diameter, .42, smallest, .30. Longest specimen, 1.15; shortest, .85.

OBSERVATIONS.

The type form prevails but there is a tendency toward a smaller form with finer striations, but these specimens are possibly only reversions toward some of the several finely striated species that occur on Inagua. Distinguished at once from all others, by the deep purplish color of the aperture, the violaceous externally, and the rather widely separated, prominent, white striations.

DISTRIBUTION AND HABITS.

I found this very handsome Strophia on the scattering shrubbery that grows on the rocky plains between the elevations that skirt the southern shore of Inagua, and the extensive salt lake of the interior, about twenty-five miles from Mathewstown.

This was during the very dry month of February, and they were fastened to the stems of trees and bushes. I think their range is somewhat further extended on this shore, but how far I cannot, at present, state.

14. STROPHIA PALLIDA Novo.

Pallid Strophia.

Plate II, 14 & 14A, shell.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thin. Striations, present. The whirls are 11. The teeth are two, and very short. Examined 25 specimens.

Form, a pointed cylinder, the first whirl measuring most in diameter and each of the next four is less in size, then the remainder taper to a short point, forming an angle of about 60 degrees. The striations are not numerous, 14 on the first whirl, rather regular, but not arranged in lines; they are slightly inclined from right to left, and the interspaces are one third wider than the prominences. The striations are not furrowed and the edges are rounded.

Aperture, very large and open and the walls within it are so thin that the striations can be seen through them. Lower tooth, not prominent, .03 high by .08 long, and its position is a little to the right of the centre; the upper is placed high and is not prominent

Margin, not produced forward beyond the diameter of the shell, is straight, very thin, with the edges slightly rolled backward. The frontal bar is moderately well developed and the elevated striations appear within it.

Color of shell, externally, flesh color, deepening to pale purple on the two upper whirls; margin, striations, and apex, white; internally, pale purplish.

DIMENSIONS.

Size of types, 1.03 by .36 and 1.03 by .33. Largest specimen, 1.07 by .40; smallest, .85 by .33. Greatest diameter, .41; smallest, .32. Longest specimen, 1.07; shortest, .85.

OBSERVATIONS.

There is a slight inclination to assume a cylindrical form but the pointed specimens are the most common.

Known by the coarse striations, thin shell, pointed form, and pale ground colors, with the white striations and margin.

DISTRIBUTION AND HABITS.

The Pallid Strophias occur on the island of Inagua in the cultivated fields that lie on the slopes of the hills that border the southern shores, between fifteen and twenty miles from Mathewstown, and possibly elsewhere on the island.

15. STROPHIA PERPLEXA Novo.

Ridged Strophia.

Plate VII, 15 & 15a, shell. and Fig. 7, a left side, b front.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thick and rather heavy. Striations, assume the form of irregular ridges. Whirls, 11. Examined 300 specimens.

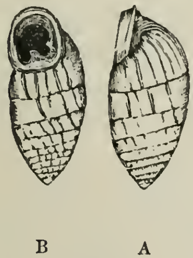


Fig. 7

Form of shell, inclined to cylindrical, the first two whirls being equal in diameter and the third is but little smaller. From the third whirl, the shell slopes rapidly to a rather blunt point, making an angle of about 60 degrees. The striations are represented by irregular, slightly elevated ridges, that are rather more prominent on the upper portion of the shell. Some of the ridges are a little flattened on the top and furrowed.

Aperture, rather small and narrows within. Lower tooth, prominent, .05 high, .24 long, and its position is just a little to the right of the centre; the upper is not as prominent but measures .05 and makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, is not inclined to either side, is considerably thickened, measuring .06, and the outer posterior portion is slightly produced backward, but there is no prominent edge. The frontal bar is well developed and the striations do not appear within it.

Color of shell, externally, white; internally, pale purplish brown which gradually fades into yellowish white on the teeth and walls within the aperture.

DIMENSIONS.

Size of type, .90 by .40. Largest specimen, 1.00 by .43; smallest, .78 by .34. Greatest diameter, .43; smallest, .34. Longest specimen, 1.07; shortest, .85.

OBSERVATIONS.

While a large percentage of the specimens of this species closely resemble the type, there is a tendency to assume a more pointed form with a less number of ridges, thus bearing a somewhat close resemblance to S. acuta, but I have never seen a S. perplexa that could not be separated from that species by the presence of more or less ridges, and by the greater thickness of the shell and its whiter color. On the other hand, some specimens exhibit an inclination to assume striations, irregular and widely separated, thus approaching S. intermedia, but the striations are never decided enough for intermedia. In possessing these characters, however, the Ridged Strophia is between the Pointed and Intermediate Strophias, and at first occasioned me considerable perplexity, as it appeared to form a connecting link between the two. But as S. perplexa occurs on Cayman Brac, apart from other Strophias, and is thus widely separated from either of the two closely allied shells, and like many species having apparently obscure characters, taken individually, yet while in mass, show strong differences, I soon saw that I could not consistently do otherwise than to consider it a distinct species, as above described.

Known from all other species, by the absence of striations but presence of ridges, white color, and heavy shell.

DISTRIBUTION AND HABITS.

The Ridged Strophias occur on the island of Cayman Brac in a barren, rocky section, about two miles from the west end of the key, and a quarter of a mile from the south shore. They were restricted to a very limited area, and I found them clinging to low herbage or to the naked rock, in almost every instance, exposed to the burning rays of a tropical sun.

16. STROPHIA NITELA Novo.

Shining Strophia.

Plate VII, 16 & 16A, shell. and Fig. 8, A, front B, left side,.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, thick and rather heavy. Striations, absent. Teeth, two, and very long. Whirls, 11. Examined 300 specimens.

Form of shell, a rather pointed oval, the first whirl is, however, the largest in diameter, the second is a little smaller, and each of the remainder is considerably less in size, thus the shell slopes rapidly to a rather blunt point, making an angle of about 55 degrees. There are only faintly defined lines of growth that assume more prominence on the back of the upper whirl. Sutures, not deep.

Aperture, large, open, measuring a little more just within than at the entrance. The lower tooth is prominent, .05 high, .24 long, and its position is just a little to the right of the center; the upper is not as prominent but measures about .04, and makes a complete turn around the column.

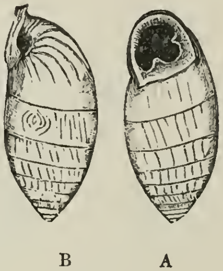


Fig. 8.

Margin, not produced forward beyond the diameter of the shell, nor inclined to either side, is not greatly thickened, measuring .06, and the outer posterior portion is provided with a thin, not prominent edge. The frontal bar is well developed.

Color of shell, externally, shining white; internally, purplish brown, which gradually fades into yellowish on the teeth and margin.

DIMENSIONS.

Size of type; 1.10 by .50. Largest specimen, 1.12 by .54; smallest, 1.00 by .44. Greatest diameter, .52; smallest, .44. Longest specimen, 1.12; shortest, .44.

OBSERVATIONS.

This species is very uniform in size and form, but some specimens show a tendency to become more obtuse.

Known from the allied S. acuta by the larger size and more obtuse form, and from S. levigata by the smaller size and smooth surface. From all others by the long teeth and absence of striations.

DISTRIBUTION AND HABITS.

The Shining Strophias occurred in numbers, in exposed situations in the patches of Guinea grass that grew on the margin of the path, of which I have spoken elsewhere, that crosses the west end of Little Cayman. They were clinging to the stems of the grass, at the roots of which lay hundreds of dead specimens. They appeared to be restricted to two or three of these small clearings.

17. STROPHIA ALBA Novo.

White Strophia.

Plate VII, 17, 17A & 17B, shell; Fig. 9, A, front, B, side; Fig. 11, section.

DESCRIPTION.

SP. CH. Size, large. Shell, not very heavy. Striations, present. Teeth, two, both short and not prominent. Whirls, 11. Examined 250 specimens.

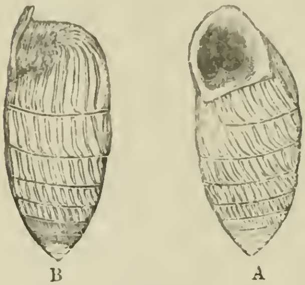


FIG 9.

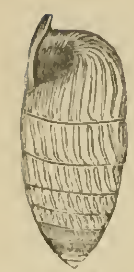
Form of shell, cylindrical, with the first two whirls equal in diameter and the third is slightly smaller; from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The striations are numerous, 24 on the first whirl; they are prominent, regular, but are not arranged in lines, are inclined from the right to the left; and the interspaces are about as wide as the prominences. The striations are flattened on top but are not furrowed and the edges are smooth and rounded.

Aperture, very large and open, measuring more just within than at the entrance. Lower tooth not prominent, .03 high by .12 long, and its position is about central; upper tooth, a mere protuberance.

Margin, not produced forward beyond the diameter of the shell, and is slightly inclined to the right, beyond the side; it is thin, measuring only .03; and the edges are slightly rolled backward. Frontal bar, not well developed but the striations do not appear within it.

Color of shell, externally, bleached white throughout; internally, pale brownish purple, fading into flesh color on the teeth and margin.

PLATE VII.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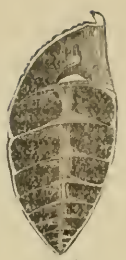
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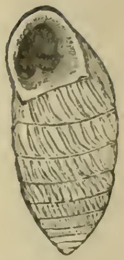
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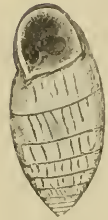
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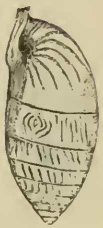
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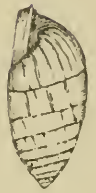
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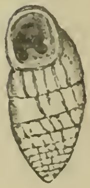
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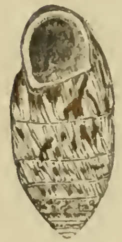
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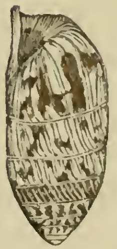
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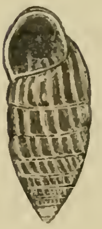
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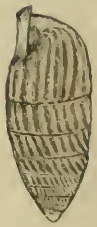
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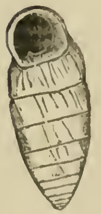
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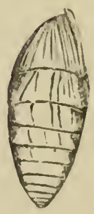
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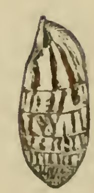
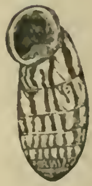

21a.


21.

C.J.M.

EXPLANATION OF FIGURES ON PLATE VII.

15. Strophia perplexa, front view of type shell: 15a, left side of another individual.

16. Strophia nitela, front view of type shell; 16a, left side of the same individual.

17. Strophia alba, front view of type shell; 17a, left side of same individual.

18. Strophia lentiginosa, front view of type shell; 18a, left side of the same individual.

19. Strophia fusca, front view of type shell; 19a, left side of same individual.

20. Strophia incana, front view of shell; 20a, right side of the same individual.

21. Strophia inflata, front view of type shell; 21a, left side of same individual.

DIMENSIONS.

Size of type, 1.42 by .55. Largest specimen, 1.27 by .58; smallest. 1.12 by .50. Greatest diameter, .50: smallest, .48. Longest specimen, 1.42; shortest, 1.12.

OBSERVATIONS.

This is a very uniform species, specimens varying very little from the type. I am not the first, by any means, to collect this species, as I have seen it in collections, but always labelled with the name of some other species, though why, I cannot well imagine, as it is one of the most strongly defined species found on the Bahamas.

This species well represents the short toothed form of Strophia prevalent on the Bahamas and in some portions of Cuba; see Fig. 10, where I have given a section of S. alba, showing short tooth, and compare with Plate II, 1B, where is given a section of S. pannosa, one of the long toothed species.

Known by the large size, open aperture, short tooth, white color, prominent striations, and form as given.

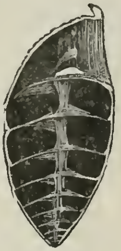


FIG. 10.

DISTRIBUTION AND HABITS.

I found the White Strophia common on the west coast of Rum Key, near the salt pond, on the low shrubbery between it and the beach, equently quite near the sand. At this time they were quiet, as the weather was dry.

18. STROPHIA LENTIGINOSA Novo.

Flecked Strophia.

Plate VII, 18 & 18A, shell; Fig. 11; A, front, B, left side.

DESCRIPTION.

SP. CH. Size, large. Shell, not very heavy. Striations, present. Teeth, two and short. Whirls, 11. Examined 150 specmens.

Form of shell, rather cylindrical, with the first two whirls equal in diameter, and the third is but little smaller; from this, the shell slopes to an obtuse point, forming an angle of 65 degrees. The striations are numerous, 25 on the upper whirl, prominent, regular, but not arranged in lines, and the interspaces are not as wide as the prominences. The striations are rounded but not furrowed.

Aperture, large and open, measuring a trifle more just within than at the entrance. Lower tooth, not very prominent, .03 high by .12 long, and its position is just a little to the right of the center; the upper is placed well above it but is a mere protuberance, yet this slight elevation makes a complete turn around the column.

Margin, not produced beyond the diameter of the shell, is not inclined to the right, is very thin, measuring .03, but the edge is not rolled backward. The frontal bar is not well developed and is smooth within.

Color of shell, externally, white, conspicuously spotted and flecked with very irregularly formed markings of purplish; internally, purplish brown which gradually fades into flesh color on the teeth and margin.

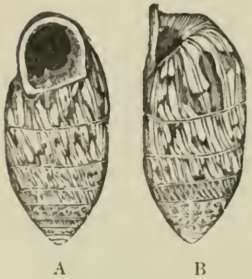


Fig. 11.

DIMENSIONS.

Size of types, 1.23 by .54. Largest specimen, 1.40 by .56; smallest, 1.10 by .48. Greatest diameter, .56; smallest, .48. Longest specimen, 1.40, shortest, 1.10.

OBSERVATIONS.

There is considerable variation in respect to color and extent of markings, some are darker than the type and some are paler; in the type, the colored portions are about equal to the white, but in some cases, the purplish predominates, and in some, especially in paler colored specimens, the spottings are comparatively few and consequently the white is in excess. The aperture is also inclined considerably to the right in some shells.

As a rule, however, the species is quite uniform in form and markings.

Known from all others, by the large size, prominent striations, open and thin-margined aperture, and conspicuous markings.

DISTRIBUTION AND HABITS.

The Flecked Strophias occur in the interior of Rum Key, where they are not very common, living in isolated groups in rather exposed situations, but among foliage and plants. The specimens collected were obtained on the western side of the island but I am, at present, unable to give the exact range of this and the preceding species, yet should judge that the habitat of both is comparatively extended.

19. **STROPHIA FUSCA** Novo.

Brown Strophia.

Plate VII. 19 & 19A, shell; Fig. 12; A, front, B, left side.

DESCRIPTION.

Sp. Ch. Size, medium. Shell, not very heavy. Striations, present. Teeth, two and long. Whirls, 11. Examined 46 specimens.

Form of shell, a pointed cylinder with the first whirl the largest in diameter, and the next two are successively smaller; thus the shell tapers to a rather acute point, making an angle of about 50 degrees The striations are not numerous, 17 on the upper whirl, quite prominent, not regular, nor arranged in lines, and the interspaces are about twice as wide as the prominences. The striations are rounded and slightly furrowed.

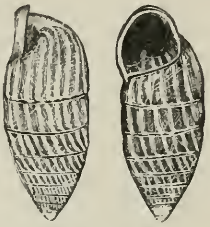


Fig. 12.

Aperture, small, but measures a trifle more just within than at the entrance. Lower tooth, prominent, .05 high by .25 long, and its position is just a little to the right of the center: the upper is placed well above it but is not as prominent, yet makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, is slightly inclined to the right, is rather thick measuring. 06, and the outer posterior portion is provided with a thin, not prominent edge. The frontal bar is not well developed and is smooth within.

Color of shell externally, brown, paler at the apex, and with the striations white; internally, pale brown which gradually fades into flesh color on the teeth and margin.

DIMENSIONS.

Size of type, 1.25 by .45. Largest specimen, 1.35 by 55; smallest, .90 by .42. Greatest diameter, 1.35; smallest, .42. Longest specimen, 1.35; shortest, .90.

OBSERVATIONS.

There is considerable variation in this singular Strophia in respect to size, as shown, and specimens are inclined to be shorter and more obtuse, in proportion to the size, and more cylindrical. Some show a thicker margin.

Known from all other species, by the brown color with contrasting, wide apart, white striations, and long teeth.

DISTRIBUTION AND HABITS.

The Brown Strophias occur on the west end of Little Cayman, low down in the thick scrub. They are quite solitary in habit, and rather rare, but it is probable that they range through the higher growth of woodland of this section, at least as far east as the mangrove swamp of which I have spoken.

20. STROPHIA INCANA Binney.

Gray Strophia.

Plate VII, 20 & 20A, shell: Fig. 13, A, front, B, right side;
Pupa incana Binney, Terr. Moll. N. A., I p. 109; III, 1851.

DESCRIPTION.

Sp. Ch. Size, small. Shell, thin. Striations, absent. Teeth, two, both short and not prominent. Whirls, 11. Examined 1,000 specimens.

Form of shell, cylindrical, with the first two whirls equal in diameter and the third is slightly smaller and the fourth is a little less in size, from this, the shell tapers to a blunt point, forming an angle of 65 degrees. The lines of growth are only faintly defined, but assume more prominence on the back of the upper whirl. Sutures, not deep.

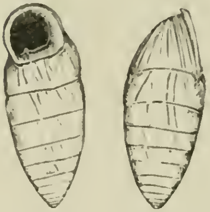


Fig 13.

Aperture, large, open, measuring a little more just within than at the entrance. The lower tooth is not prominent, .02 high by .08 long, and its position is just a little to the right of the center; the upper is a mere protuberance, yet makes a complete turn around the column.

Margin, not produced forward beyond the diameter of the shell, nor is inclined to either side, is very thin, measuring only .02, and the edges are slightly rolled backward. Frontal bar, not well developed.

Color of shell, externally, grayish white throughout; internally, yellowish white.

DIMENSIONS.

Size of type; 1.05 by .40. Largest specimen, 1.07 by .67; smallest, .67 by .35. Greatest diameter, .41; smallest, .30. Longest specimen, 1.05; shortest, .67.

OBSERVATIONS.

As shown under Dimensions, there is great variation in size, in this species. This extreme difference has caused me considerable perplexity, for this seems to indicate much more than individual variation, and, in fact, rather more than varietal difference. These extremes represent two forms which show in the hundreds of specimens examined, but a small percentage of gradation. Then the smaller form is smoother and whiter, with the first three whirls nearly, equal in diameter; all are more bulging, and only 10 in number. These characters certainly show a strong tendency toward assuming specific rank, and with complete isolation from the larger form, would soon become fixed enough to warrant a name, but as the shells inhabit a very limited area, I leave them as they are for the present, under the name of S. incana.

Mr. W. C. Binney in "Land and Fresh Water Shells of N. A.," page 247, says that he has seen a variety of S. incana with longitudinal markings; in this, however, I cannot well avoid thinking him mistaken, some other species evidently being indicated. In his quotation of locality of specimens, he gives Key Biscayne, Fla., and from this island he may have got his colored specimens. As this latter named place is over 100 miles, in a direct line, from Key West, with numerous water ways through which the tides sweep with great force, between, this distance would afford more than sufficient isolation for the evolution of a distinct species, even if the original stock were S. incana. This seems to be a matter that requires special investigation, and for further remarks upon this subject see under head of Observations in forthcoming species.

Known from all other species, by the absence of striations, white color, with the very pale interior, small size, thin shell, and short teeth,

DISTRIBUTION AND HABITS.

The Gray Strophias occur in a limited area, on the island of Key West, Florida. According to my experience they are restricted to that portion of the northern side of the key that lies between the salt ponds and the Gulf of Mexico. In habit they are somewhat peculiar, as many hybernate beneath stones, and as spring advances, emerge to feed upon the short herbage that grows rather scatteringly in the section in which they live.

This species is said to occur in Cuba also, but I have never seen a specimen from that island, nor have I ever met with it on other of the Florida Keys.

NOTES ON THE ANATOMICAL STRUCTURE OF THE CROWNED CRANE.

The following notes were taken from a dissection of a Crowned Crane, (Balearica) which had been kept in confinement in one of the "dime museums" in Boston. The body was kindly presented to me by Mr F. B. Webster.

Tongue, about two inches long, pointed, fleshy at base, but becoming horny at tip. Superior larynx, fairly well developed, but exhibits nothing remarkable in structure.

Trachea, simple, rounded, and unlike this organ in many other members of this family, does not make any convolutions, nor enter the keel of the sternum, being straight. It is 14.00 long to the inferior larynx.

Inferior larynx, provided with a sterno trachealis that is well developed, but there is not the slightest vestige of any other laryngeal muscle. The bronchials are furnished with wide tympaniform, or vibrating membranes that extend their entire length. The os transversale although present, does not support a semiluna membrane, thus the broad tympaniforms are the only sound producing organs, with the sterno trachealis as a relaxor. If the voice of this Crane has any of the peculiar resonant harshness of other members of the family, it is partly due to the great length of trachea, thus being produced much as in the herons.

Œsophagus, straight, being without any special dilatation and is 18 00 long.

Proventriculus is comparatively small, the glands are numerous, small, spherical in form, and are contained in a zonular band which is 1.30 wide.

Stomach, a flattened sphere measuring 2.40 by 2.15 by 1.45, is very muscular, the walls being extremely thick, — 1.00 — and the lining membrane is hard, rugose, somewhat wrinkled, and orange in color.

Fold of the duodenum, 4.20 long, enclosing a singularly formed, double, or forked pancreas that does not extend within 1.25 of the end of the fold, but reaches considerably beyond it, along the intestine; it is 3.50 long.

Gall sack, large, perhaps abnormally so, as noticed in many birds kept in confinement, and a double gall duct enters the intestine just below the termination of the pancreas.

Right lobe of liver, as in the great majority of birds, greatly exceeding the left in size, and from it emerges the hepatic artery. Right carotid artery, well developed.

Intestines, small, averaging about .25 in diameter, but are 29.00 long.

Cœca, well developed, the right being 3.25 long, and the left, 3.00. The blind ends are pointed or but slightly dilated. Beneath the right, the intestine has made an abrupt bend, in which its diameter is considerably increased. This bend has become permanent, by having been fastened by tissues to the cœcum that crosses the loop. This modification is, beyond doubt, abnormal, or perhaps better, a character possessed by this individual crane, only, yet it is quite suggestive of the possible origin of a cœcum.

This arrangement may be better understood by a reference to Fig. 14, where is given a cut, about one third life size, of the cœca of this individual crane. a, intestine; b, right cœcum; c, left; e, rectum; d, cœcal bend.

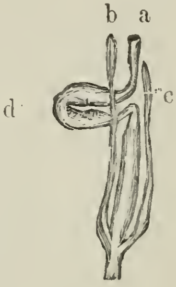


Fig. 14.

The loop is an inch long, thus some two inches cf the intestine are involved, and this portion, probably through the slower passage of food, has become enlarged, thus presenting a more extended digestive surface. The nutriment derived from this is taken up by absorbents that pass around on the inside of the bend. Even this change in the alimentary canal of this individual, must prove of slight benefit to it, and judging from the recorded instances of the transmission of accidentally acquired characters from parent to offspring, may have appeared in the progeny of this bird, but perhaps in a rudimentary form. The enlargement of the loop suggests that the cœcum first became developed by the bulging outward of the walls of the bent portion of the intestine, rather than by the fusion of closely approximating walls and the disappearance of the intersecting portion.

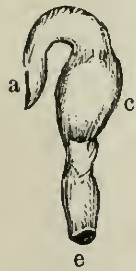


Fig 15.

This hypothesis is, in a measure, confirmed by the examination of species in which, through disuse, the cœca have become rudimentary. Such an example may be seen in the cœcal enlargment of Cory's Gannet, illustrated by a life size sketch in Fig 15, a being the intestine, c the enlargment, and e the rectum. Here, as in other birds where the cœca are comparatively functionless, the organs have not become dwarfed, but have become reduced in much the same manner as they were developed.

ON THE PROBABLE EVOLUTION OF THE TOTIPALMATE BIRDS, PELICANS, GANNETS, ETC.

The Totipalmates constitute one of the strongest marked, most isolated, natural orders among birds. In fact, at no point do any of the members really intergrade with those of any other group, and if they ever did intergrade, the connecting links have long been lost.

Widely separated as some of the families of this order are, yet they all possess certain common characters that at once proclaim their relationship. For example, at first sight, there is very little resemblance between the Anhingas, with their sharp bills, small heads, long necks and tails, and slender form, and the short necked, clumsily formed Pelicans, with their long bills and immense gular sacs. While on the other hand, neither Pelicans nor Anhingas appear to have much in common with the swiftly flying, elegant Tropic Birds. Nor is all this difference only apparent, for in spite of the few characters which bind the group together, and show the common ancestral origin of the members, each family in the order is nearly as sharply defined, and as highly specialized, as is the order itself.

The external common characters are two; first the web that connects the hind toe with the anterior toes, more or less well developed; second, the gular sac. Both reach their maximum developement in the Pelicans, and the first its minimum in the Frigate Bird, and the second in the Tropic Birds.

The deterioration of the parts mentioned is due to the fact, that with the developement of other organs or members, these not being of special service, become, in a measure, functionless. For example, the power of flight in the Frigate Birds, has become developed to such an extreme degree, more than in almost any other species, they being constantly on the wing, that the feet have become comparatively useless. Insomuch so, in fact, that it is with difficulty, that the birds can perch at all, while upon the water, they are perfectly helpless. Thus, this so called totipalmate swimmer is as much at the mercy of the waves, if it should chance to fall into them, as would be a Chimney Swift under similar circumstances.

Neither the Frigate Bird, which gains a living either by robbing other birds or by expertly fishing for itself, nor the Tropic Birds which are also most excellent fishermen, both taking their prey, that consists principally of flying fish, while upon the wing, have any occasion to use a gular sac, with which the slowly moving Pelicans literally net their finny booty. yet the sac is present in both.

It is to the internal structure that we must look for the most constant character, one that has not only preserved its peculiar features but, in a great measure, function, through all the varying changes that the several members of the group have undergone, in order to meet the varying exigencies under which the different families live. I refer to the singular sternal structure, which briefly is as follows. The keel is low, but the sternum broad, while the posterior margin, as in most of the strongly flying birds is entire. This arrangement offers a firm attachment for the powerful muscles of flight; but above all, the terminal portion of the furcula, or wishing bone, not only comes in contact with the keel, that is produced forward to meet it. but is soldered so firmly there, that the saw is required to separate the two bones.

This plan for giving great strength to the shoulder girdle, evidently had its origin in bulky birds which were obliged to rise from the water with considerable weight of fish in their gullet, as in the Pelicans, a feat that requires no inconsiderable strength of wing; now, however, it has been but slightly changed to secure long continued flight and power of performing rapid aerial evolutions. It is one of the best arrangements for this purpose, that is presented by birds to ensure strong flight, and thus even the sternum of the Frigate Bird that spreads his powerful pinions and outrides the hurricane, is constructed upon essentially the same plan. In this family, however, the sternum is shortened, the coracoids and furcula greatly enlarged and also firmly soldered together, while the coracoids at their basal ends are fastened to the sternum with ligaments that are so hard as to have become nearly ossified.

But it is sufficiently obvious that in maximum or minimum development, the three characters that bind the members of this order together, are always present and their presence most clearly points to the conclusion, that the common ancestor of these families must have possessed all of these characters, and all developed in a marked degree. As the Pelicans exhibit all of the characters, not only in maximum development, but also fulfilling functions that are essential to the lives of the species, we are forced to consider that this family is nearest to the common ancestor, and the others more or less remote.

An idea of what appears to me, the most probable method of the evolution of all the families of the Totipalmates, may be had by a reference to the annexed diagram.

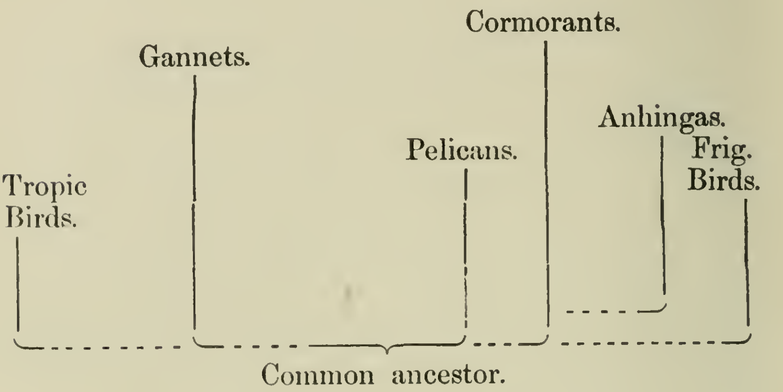


DIAGRAM ILLUSTRATING THE EVOLUTION OF THE TOTIPALMATES.

The horizontal line represents the common ancestor, and the broken lines in it show where more or less connecting links have been lost; the perpendicular lines show the families, their length the comparative number of species that each contains, while their distance from each other and from the common center, exhibit their present relationship.

First in order to the left, at a considerable distance from the center, and at a wider distance from the Pelicans, are the Gannets. This is a large family and is considerably changed from the original form. Beyond them, most remote in this direction, is the little family of Tropic Birds, so completely changed as to bear very little resemblance to any other. To the right, nearest the center, as being, as already said, the closest in relationship to the common ancestor, are the Pelicans, not a large family. Not far beyond them, are the Cormorants, the largest family of all. From this group, have evidently become evolved the Anhingas. I place them here, as in many ways they are allied to the Cormorants, and in spite of their sharp beak, must have been an offshoot from them, but as indicated by the dotted lines, connecting species are lost. Most remote of all to the right, equal in distance from the common ancestor, with the family from which it differs the most—the Tropic Birds—but nearer the Pelicans than it is the small family of Frigate Birds.

As a rule, the larger the family, the more plastic has it become, while species among the small families do not appear as susceptible of change. In other words, while it is extremely probable that neither the Frigates nor the Tropic Birds have produced any new species for a great length of time, the same is quite as evidently not true in regard to the Cormorants and Gannets, for here species have much more recently appeared.

As I have given much attention of late to the Gannets, some of which have a wide range, I here give my idea of the evolution of this family as represented by American species. This is illustrated by a diagram arranged much as in that illustrating the order.

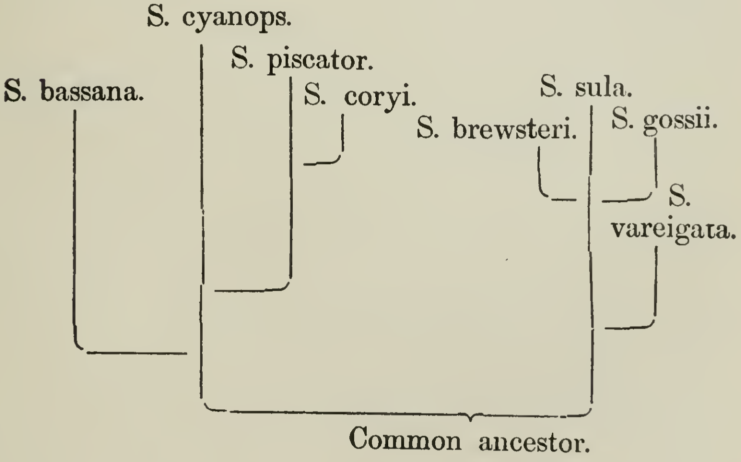


DIAGRAM ILLUSTRATING THE EVOLUTION OF GANNETS.

The horizontal line represents the common ancestor. This was doubtless a dark colored bird. I have thus concluded, after observing the inclination among all the species to revert in some way toward this color. The perpendicular lines represent the species, and their length, the comparative abundance and extent of range of each.

To the left, nearest the common ancestor is the Booby Gannet, S. sula, showing its relationship to the parent stock in the brown young, and partly brown adult. From this stock, has become evolved, the closely allied Peruvian Gannet, S. variegata, Brewster's Gannet, S. Brewsteri, and Blue-footed Gannet, S. Gossii. All of these offshoots from S. sula have a very limited range. In fact, as has been seen in the related habits of Cory's Gannet, the Tropical American Gannets, and perhaps elsewhere, are inclined to form clans or colonies apart from the original breeding grounds, and a colony once formed, the members and their offsprings return to it to breed season after season; thus the colony is practically, as completely isolated from the parent stock, as if a thousand miles of water intervened, when in reality, often the nearest land will be chosen.

Isolation, so complete, once established, then follows certain change, for it appears that circumstances are favorable to promote such a change. I believe that any completely isolated colony of animals, no matter where placed, with the rare exceptions given on page 87, will change, but in the tropics, Gannets appear to be placed under the most favorable circumstances for changing, aside from reasons already given for inducing variation, which evidently applies more particularly in this case than in others. It is probable that the species of a given family become most plastic, that is, most susceptible to change, as we approach the center of greatest distribution of that family.

But to return to the explanation of the diagram. To the right, at a greater distance from the common ancestor than is S. sula, is S. cyanops, Blue-faced Gannet, having a very wide range. This species exhibits reversion in the constantly brown tail and brown markings of the adult, and in the wholly brown young. From this stock, has become evolved S. piscator, Red-faced Gannet, a species that also has a wide range and that exhibits a decided tendency to revert toward the common ancestor, in the brown tail, mixed "off" plumages sometimes assumed, and in the wholly brown young. From this stock has sprung S. coryi, Cory's Gannet, having a very limited range, but rather strangely showing a stronger tendancy to revert toward the original stock than either of the two forms that precede it. This is shown in the tendency of the adult to assume a dark dress, in the peculiar brown phase of plumage mentioned under description of this species, in No 1 of Contributions, pages 43 and 56, in the mixed "off" plumages, and in the wholly brown young. From cyanops on the left, first evolved of all, has sprung S. bassana, Common Gannet, the only true migratory species in the family, and the only one that ranges far from tropical or subtropical waters

This species appears the most fixed and unchanging and only exhibits a tendency toward reversion in the mottled young and in the rare mottled "off" plumage.

The fixed characters of the Common Gannet are worthy of attention as evidence not only of long continuance of the species, but as in a great measure, substantiating the hypothesis that a species at the greatest distance from the center of greatest distribution is the least liable to change. Today 2,000 miles intervene between the most southern breeding ground of the Common Gannet on Bird Rock, Gulf of St. Lawrence, and San Domingo Key, about forty miles north of Cuba, which is the the most northern nesting place of the Blue-faced Gannet, or a closely allied species, and it is extremely probable that these two Gannets have not been much nearer together, while breeding, for many centuries.

In the Common Gannet then, isolation has become so complete, and has been so long continued, that this species presents very strong differences, differences so great, in fact, they have, in some degree become generic. See especially in this connection, article on the Comparative Anatomical structure of the Gannets in next number of Contributions.

I have suggested, on page 47, that the almost abnormal sensitiveness of the young of tropical born Gannets, caused by the fostering care of the parents, has been followed by physical degredation, which may be the prime factor of the rapid evolution of species in the south. I have also shown that the progeny of the stronger, northern born species do not possess this sensitiveness. It is most evident from some reason, that specific characters have become so strongly fixed in the Common Gannet that this species has become one of the rare exceptions to the rule that complete isolation inevitably produces change.

Knowing, as we do, the very strong inherited attachment that this species exhibits for certain breeding grounds, we must concede that the Common Gannets breeding on either side of the Atlantic, thousands of miles apart, are completely separated, yet if there be any difference between European and American specimens, they are too slight to have attracted the attention of ornithologists.

SUMMARY.

The facts presented in the foregoing paper are recapitulated in the following summary.

1. The totipalmate group—order Steganopodes of recent ornithologists—is one of the most clearly defined among living birds.

2. Each family in the order stands as distinctly apart from the others as does the order itself in the sub-class birds.

3. All of the families, although so distinct, bear ample evidence in the three characters, totipalmate feet, gular sac, and anchylosement of the furcula and keel, of having been evolved from one common ancestor, which was not the direct progenitor of the other swimmers.

4. Species possessing characters that were intermediate between extant families have been lost, if they ever existed.

5. The Pelicans are the nearest representatives of the extinct common ancestor.

6. The Frigate Birds on one hand, and the Tropic Birds on the other are the most distant from the common ancestor.

7. The Anhingas present the only example where one family has become evolved from another, they having had their origin from the Cormorants.

8. Families containing a small number of species, do not appear susceptible of change, as in the Tropic and Frigate Birds.

9. Large families are constantly evolving species; of these the Gannets and Cormorants offer good examples.

10. From two species of Gannets, now living, have become evolved all of the existing species.

11. Gannets living in the tropics are more susceptible to change than those living in more northern regions.

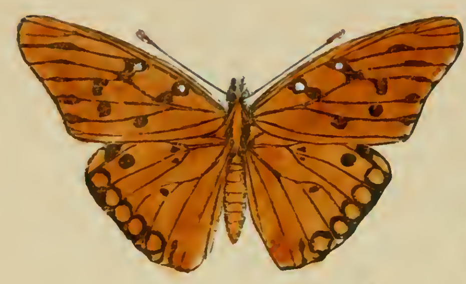
12. Though amenable to the common law that ordains that species in all animals are most liable to change nearest the center of greatest distribution, yet physical degradation, brought about by the over fostering of the young, is given as a prime factor that renders species susceptible to change.

13. The Common Gannet living apart from the center of greatest distribution, and producing stronger young, has not evolved a single species, or at least none now living.

DESCRIPTION OF A NEW SPECIES OF BUTTERFLY FROM THE WEST INDIES.

The following is a description of a species of Agraulis from the West Indies that I have seen in collections labelled as A. vanillæ. But after examining some two hundred specimens from New Providence, Andros, Rum Key, and Inagua, Bahamas, and from Cuba, Jamaica,

PLATE VIII.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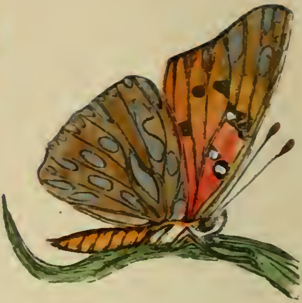
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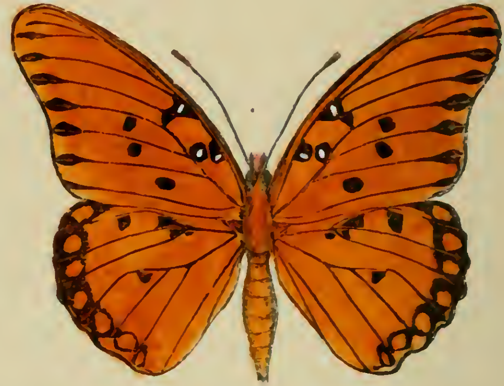
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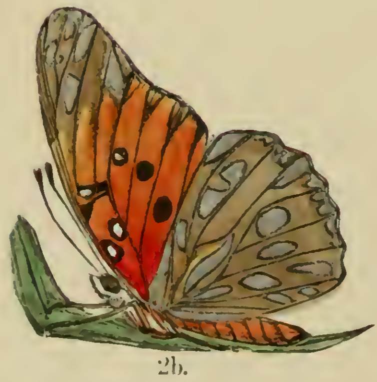
2b.

2c.

2c.

C. J. M.

EXPLANATION OF FIGURES ON PLATE VIII.

1a. West Indian Silvery Butterfly, Agraulis insularis, upper side: 1b, lower side of same.

2a. Silvery Butterfly, Agraulis vanillæ, upper side; 2b, lower side of same; 2c, chrysalis of the same species.

and the two smaller of the Cayman Islands, all of which present similar and clearly recognizable characters, I have concluded that it should be, most unquestionably, separated from A. vanillæ. I can find no description of any species of Agraulis from the West Indies, and Kirby does not even give vanillæ as occurring there.

AGRAULIS INSULARIS Novo.

West Indian Silvery Butterfly.

Plate VIII; 1a, upper side of type male: 1b, lower side of same.

DESCRIPTION.

Sp. Ch. General pattern of coloration, similar to that of A. vanillæ, but the ground color is paler, the size smaller, and the wings are broader in proportion to the length.

Color. Male, above, orange, with edge of basal half of upper margin of primaries and all but the basal portion of the widened veins, dusky. Lines along the outer portion of the veins, narrow and short on the upper two, longer and wider on the next two, and on the four below assuming the form of rather irregular oval spots, black, as are the remainder of the markings unless differently indicated. In the outer portion of the central cell are two rather square spots fused together, and in the upper of these is a white dot. Below these, near the center of the cell, are two rounded dots which come in contact at one point, and one of which, the upper, is nearer the base of the wing than the other, and has a white dot near its center. In the cell below the central, about one third the terminal length of the wing is a triangular spot, base upward, and in line with it, in the cell below, is a rounded spot of about the same size. Nearer the base of the wing, in the cell below, base inward, is a triangular spot with the corners rounded.

Secondaries, with the veins not dusky. Band on outer margin, enclosing prominent rounded spots of the ground color, one to each cell; this band does not reach the lower border of the wing, and in the cell above the lowest, the spot opens out into the ground color above and below. In the cell below the upper, is a rounded spot and at its base is a smaller triangular one, and in the base of the cell below it, is one, also triangular, but smaller; both have the base outward. In the cell below the central, is a prominent square spot. A very narrow edging of black on the outer portion of the primaries and the bordering on the secondaries, is interrupted with minute, elongated spots of white.

Beneath. Primaries, rusty brown at the apex, and in this field are six silver spots of irregular form, arranged in two lines; the upper spots are smaller, the two upper are quite small, and each in this line are successively placed in one cell above the corresponding outer. Spots on the terminal marginal portion of the three lower veins are of a dusky rust brown, and in the upper of the three, are two silver dots, one above the other. The black spottings near the center of the wing, given above, are repeated below, but the two in the middle of the central cell do not quite come in contact, and the lower of the outer spots has an elongated, perpendicular, spot of white, and the two other white dots are larger. The ground color of the inner portion of the wing is dull orange, becoming gradually crimson towards the base; the upper margin of the wing is rusty.

Secondaries, rusty brown, with a marginal line of silver spots extending around the entire wing. Three of the spots on the outer margin, one very near the upper portion, one near the center, and one near the lower portion, are three times as large as the others. In the center of the wing are seven silver spots of various forms; the largest is oblong, and is encroached upon from above, in the center, by a patch of ground color, edged with black, dividing it nearly in two, and the other spots are margined with black, nearest the base of the wings; inside this and below it, is a spindle shaped spot, slightly bent; the other spots are long ovals.

Female, similar to the male, but dull orange above, with a band of black extending from the lower side of the two pairs of fused spots in the central cell, thus connecting them together. Below, slightly paler; there are seven silvery spots in the apex of the primaries, and a second terminal spot near the outer margin.

Body, palpi, and feet, orange above, white below; antennæ, black, club, tipped with orange; eyes, brown, in both sexes.

DIMENSIONS.

Type male of A. insularis. Spread of wings, 2.40. Size of primaries, 1.20 long by .65 wide; secondaries, .75 long by .78 wide. Antennæ, .60 long. Length of body, including the head and palpi, .80.

Type female. Spread of wings, 2.50. Size of primaries, 1.35 by .80; secondaries, .80 by .80.

Average size of A. vanillæ. Male. Spread of wing, 3.00. Size of primaries; 1.60 by .80; secondaries, 1.00 by .80. Antennæ, .70. Length of body 1.20.

Female. Spread of wing, 3.40. Size of primaries, 1.60 by .80; secondaries 1.20 by 1.00.

OBSERVATIONS.

Individual variation in this species is not very marked even in individuals coming from widely different localities; in fact, I can see no difference between specimens taken on New Providence and Cayman Brac.

The nearest ally to the West Indian Silvery Butterfly is Agraulis vanillæ, Silvery Butterfly, from the Southern United States, but A.insularis differs from it in being paler, in having the two inner spots in the central cell fused together, these being separate in vanillæ, and in having only two white dots in the four spots in this cell, not three as in vanillæ, this species having an additional dot in the lowest spot, as seen in Plate VIII, 2a, where the upper side of a male Silvery Butterfly, from Sandford, Florida, taken Oct. 15, 1887, is represented: compare with figure of the type male of A. insularis, ib. 1a. taken on Andros, Bahamas, Dec. 20 of the same year. Below, vanillæ has seven spots in the apex of the wings of the male, and an additional pair in the second terminal spot below the rust colored field on the primaries.

One of the principal and most important differences, as will be seen by a comparison of the dimensions of the two species, is that A. insularis has assumed structural differences, and that the wings are wider than those of the continental species in proportion to their length. This is especially discernible in the secondaries, which are not only as broad as they are long. but are sometimes actually wider than long, whereas in vanillæ, the reverse is the case, and the secondaries are always narrower than long. The fact that this proportional difference gives us an important specific character, illustrates the utility of taking the dimensions of the wings in the manner shown, not only in this article but also in my Butterflies of New England, a method not usually practiced by Lepidopterists.

DISTRIBUTION AND HABITS.

There is little reason to doubt but that this West Indian Butterfly is found throughout the Bahamas and Greater Antilles, although I have never seen it elsewhere than from the localities noted at the beginning of this article.

I have never seen the larvæ nor the chrysalis, neither do I know the food plant. but judge that it is the sweet potato, as with the Silvery Butterfly in the south. If such be the case, the small variation shown by the species throughout its range is easily accounted for, as the sweet potato is constantly being transported from place to place and thus the earlier stages of the insect would be likely to accompany the vegetable, thereby preventing isolation and subsequent changein the sqeices.

In habit, this butterfly appears to differ but slightly from the allied species, being found in open spots and fields, feeding on flowers. Both species are very active but A. insularis is, if anything, more sluggish than the continental species. A. vanillæ disappears in winter, it being difficult to find specimens even in southern Florida, after the middle of November, whereas insularis flies all winter, and is thus an omnipresent species in all the region over which it ranges. One important habit which I have observed with A. vanillæ, and which I have never seen practiced by the West Indian species, is migration. A. vanillæ rises in the air in clouds, in company with other species, and allows itself to be blown along by the wind, after the manner practiced by other butterflies. But I have never, in all my voyaging through the Bahamas and among the West Indies, observed any flight of insularis. On several occasions, when approaching the coast of the Southern States, even when forty or fifty miles at sea, I have seen the air absolutely filled with the Silvery Butterfly, hundreds of which flew against the sails and fell to the deck. In consideration of this fact, it would be very singular if typical vanillæ did not occur on the Bahamas, as less than fifty miles of water lies between the southern coast of Florida and the nearest of the Bahama Keys; yet I have never seen a specimen east of the Gulf Stream. The shorter, wider wings of A. insularis seem to indicate that it does not fly as much as its relations. It is a fact, that land birds, constantly resident on islands, have shorter, rounder wings than allied species on the mainland, as a consequence of their flight being more limited, but I have never seen it recorded that this law of evolution also includes insects.

NOTES ON THE BLACK SNAKE, BASCANION CONSTRICTOR.

On the 5th of last May, as I was searching among some bushes on the margin of a swamp, for the larvæ of grasshoppers, I caught sight of a large black snake that was lying in an open place which it had evidently been in the act of crossing, when its progress was arrested by my appearance. I say the reptile was large, so it was a good sized one for this section, and would have been called a ten footer by any person who estimated its length with his head over his shoulder, while hastily endeavoring to fill an engagement that he suddenly discovered he had in another part of the field. The yard stick, however, afterwards demonstrated the fact that this individual serpent was seven feet long.

Naturally the reptile saw me some time before I perceived him, and when my eye fell upon him, he was lying perfectly quiet, after the manner of reptiles of this class, hoping thus to escape observation. Like many animals, placed under similar circumstances, the snake became aware that it was seen the instant that I observed it, and then betrayed an inclination to steal away quietly, still evincing the idea whi chevidently possessed him, that it was best to get away from a supposed enemy as quietly as possible.

As I wanted a black snake and as this one appeared to exactly fill the required desideratum, I made a movement in its direction. Directly in front of the reptile, lay a wide open space of dry swamp, and I knew I could easily overtake even a black snake, before it could cross to the bushes opposite.

Of this, however, he appeared equally aware, for I had not taken a half dozen steps in his direction, when he most unexpectedly changed his tactics, and being some ten feet away, turned in his track and charged at me. I spread apart my feet and stooped half over to stop him, but so agile were his movements, that he passed directly beneath me, and was ten feet behind me before I could make up my mind as to just where to grasp him.

Now it was very obvious that this reptile was an old stager, and the many stratagems to which he had been obliged to resort in the past in order to save his skin intact from various enemies, more especially man, had evolved considerable more thinking surface to the brain of this individual snake, than is usually possessed by these animals. That he had acquired the length of seven feet in so populous a region as that in which he lived, was testimony of the possession of some sagacity.

That I did not run away when he made the onslaught, was evidently quite astounding to his snakeship, and had his physical evolution proceeded as far as his mental, he would have fairly rubbed his eyes in astonishment. He did not pause very long to think, however, but again came toward me headlong; this time, as I was better prepared, he did not quite come up to me, but swerving one side, managed to get into some bushes. Here, being in a measure protected from any direct attack, he coiled, just as I have seen rattlesnakes do, and elevating his tail, vibrated it with great rapidity, striking the leaves and loose debris lying about, with it, thus producing a buzzing sound, not unlike that made by the rattle of the rattlesnake. His head was drawn back ready to strike, thus every attitude simulated the venomous serpent. Seeing that I was not sufficiently awed by this proceeding, but that I continued to advance, the animal again changed the programme and began dodging about among the bushes, moving with the speed that characterizes the species. As the patch of under growth in which he had taken refuge, was small, I easily kept him from getting into any more extended area, it being evidently his intention to reach the more continuous growth.

This zigzagging about in the foliage continued for about ten minutes, during which time I gave the snake no rest. Then seeing what appeared a good opportunity, I rushed forward to secure my prize, when most unexpectedly, the snake mounted through the bushes to their tops, going from them to the lower branches of a small birch tree, and continuing upward, made his way to the swaying tip, some fifteen feet in air, performing the feat nearly as quickly as a squirrel could have done. From this elevated post, he then looked down at me in triumph. His exultation was short lived, however, as a vigorous shake of the slender tree brought him down, and as he fell on the soft bed of leaves at my feet, I threw myself upon him and succeeded in capturing him. At the last moment, this most wonderful snake did not lose its head, and by an unexpectedly sudden movement, managed to fasten its teeth in one of my fingers, inflicting some quite deep scratches.

My principal object in capturing this snake, was to try and subdue it into tameness, but I must say, that it was the fiercest reptile of this description that I ever possessed. After keeping it for nearly two months, it would barely permit me to handle it, without struggling to escape, and never failed to strike at me or any one else, whenever it had a good opportunity, and once succeeded in cutting several deep gashes in the back of my hand. These, however, healed without any trouble and never gave me any pain.

This snake always continued to vibrate his tail whenever annoyed and would coil and strike exactly as a venomous serpent performs the act, even launching himself forward so that the upper teeth, and not the lower, were fastened into the object that incited his anger. After striking, he never attempted to retain his hold but instantly withdrew his head: in short, his imitation of the manners of poisonous snakes was perfect.

I have noted the sagacity displayed by this particular black snake when I endeavored to capture it, and whenever I took it in my hands, it displayed considerable intelligence in the ingenious methods that it had of attempting to escape. It would sometimes softly wind its coils around my arm or body, then without having excited suspicion by any undue pressure, would suddenly contract the muscles of the body in a firm hold, at the same time would jerk the head backward, to endeavor to withdraw it from my hand as I held it by the neck. Not succeeding in this, he would as unexpectedly loosen his body, and falling with his whole weight, give several violent contortions as soon as the fall was checked by my hold, thus endeavoring to jerk himself free. At other times he would gradually work his body forward, so as to push sufficient length of neck through my hand to turn his head suddenly and seize my fingers with his teeth, a method of attack which I have seen practiced by the ground rattlesnake of Florida.

Although, as remarked, this snake after a considerable time, would permit me to handle him without constantly attempting to escape, I never felt perfectly safe with him, as I never knew just when he might strike, and as shown, the wounds inflicted by his teeth were quite severe, so I suffered him to attain the object for which he had been constantly striving, viz.: gain his liberty.

Snakes of this species that I have hitherto owned, or have seen in the possession of others, were quite tractable, very readily becoming so tame as to evidently enjoy being handled. They also learn to recognize their master, and I once saw this illustrated in a rather unpleasant manner, at least to me. A friend brought in a large Bascanion constrictor that he had tamed perfectly, and taking it from beneath his coat. laid it down near me. I reached out my hand toward it, when it bit with the utmost promptness, fastening on my thumb. Although its master at once lifted it up without it evincing any hostility, it was some time before I could induce it to come to me without exhibiting signs of anger.

It is extremely probable that herein lies the great secret of serpent charming as practiced in the East. A charmed serpent is simply a tamed serpent; and as some species become tame much more readily than others, this fact is taken advantage of by the operator. There are also now, as of old, serpents " who will not listen to the voice of the charmer, charm he never so wisely." For example, I have yet to see a member of the genus Lampropeltis. of which the chequered adder is an example, that is not "charmed" from the beginning of its capture. Heterodon platyrhinos, the blowing adder, although quite a fierce reptile when first encountered, is readily tamed. On the other hand, the individual Bascanion which gave rise to this article, would not become tame at all, and the water snakes, Nerodia, are untamable and fierce. Although I have never tried the experiment, I should imagine, from my experience with them, that the moccasin, Toxicophis piscivorus, would be quite a docile species. One must have courage and boldness however, in handling poisonous serpents.

Now I know of but one other instance of a native snake of any kind beginning an attack upon man, aside from the one noted, although I have often heard of such. The black snake is said to attack human beings quite frequently, but as these reports have come from persons who were evidently greatly terrified at the sight of the reptile, I never gave the subject much attention nor credence. The other case that came under my notice, occurred a number of years ago and also with a black snake. I was endeavoring to obtain a shot at a prairie warbler, that was among some low bushes, when by some chance I put my foot upon a Bascanion that was about five feet long. Feeling it beneath my foot, I simply lightened the pressure so as not to injure the reptile, and continued to look for the bird, which after a moment, I shot, when at the report of my gun, much to my astonishment, I saw a second snake emerge from the bushes near, glide rapidly up to me and strike two or three times at my foot. beneath which lay its writhing companion, and probably mate, as the new comer proved a male while the other was a female. I secured both, and they became very tame, living in confinement for several months, then finally, by accident, effecting their escape. This also occurred in May.

Scientifically speaking, it is needless for me here to state, that the black snake is harmless, and as shown by my experience, the wounds inflicted are innoxious; it is, I presume, as useless to endeavor to convince the average member of the country population, that there is no necessity of being afraid of even a ten foot long black snake, even should it venture to make a sham attack, for the purpose of seeing how many rods of rough country a seriously alarmed human being is capable of covering in a given time. I should not consider even quite a small child in any danger from the attacks of even a very large snake of this species, but human nature is not yet educated up to the point when assurances of this kind will be much heeded, and I greatly doubt, owing wholly to education, if there are a dozen men today in New England who would have the nerve to await calmly, unarmed, the onslaught of even a moderately sized black snake.

Unquestionably, black snakes do destroy some birds; possibly, in the country, some young fowls fall victims to their appetite, but very few, as snakes feed but seldom; while the smaller species of snakes are unquestionably useful to the husbandman, as they consume a large number of insects, and I unhesitatingly say that a striped snake is as much entitled to legislative protection as is a robin.

PUBLICATIONS RECEIVED.

The Birds of the West Indies. By Charles B. Cory. Estes & Lauriat, Boston. 1889.

Although much of the matter contained in this volume of 324 pages, has appeared in the "Auk," yet this is a most welcome and long needed work, and as it is the latest. is by far the best that has ever been written by the author. The work begins with a list of the principal works and papers relating to West Indian Ornithology. The descriptions are carefully prepared, and are written in the clear, though concise manner, which is characteristic of the author, and are accompanied by full synonymy, as far as pertains to West Indian records. In an appendix, the work is brought up to date, and is well indexed, while it is concluded with two maps of the West Indies.

Mr. Cory has done more for the ornithology of this region, than any one else, and is still zealously continuing his researches The work which he has here given us is, we trust, only a beginning of what he has in store. This being, in a great measure, a pioneer work upon the birds of this section, involves more labor than is at first apparent, for there are many obstacles to overcome, hence inadvertences are more liable to occur than in books that treat of more frequently worked fields. Thus the few minor errors that appear are perfectly excusable. I, for one, shall not attempt a word of adverse criticism, and am sure that I only express the sentiments of the ornithologsits of the world, in this and in saying that Mr. Cory has written the most important work on American ornithology that has appeared within the last ten years.

On the Evolution of the Rattlesnake. By Samuel Garman Author's extra from the Proceedings of the Boston Society of Natural History, Vol. XXIV, Jan., 1889.

In this very interesting paper, upon a most interesting subject, Prof. Garman has given conclusive evidence of the gradual evolution of the rattle of the rattlesnake, from the tails of venomous serpents that are not provided with such an appendage. Prof. Garman, is inclined to think the rattle of the rattlesnake beneficial to it, rather than detrimental. He also shows that the number of rings of which the rattle is composed cannot be depended upon as indicating the age of the animal, as it is evident that the snake acquires a new ring with every moult, and from one to several moults are undergone every season.

ON THE LATERAL CANAL SYSTEM OF THE SELACHIA AND HOLOCEPHALA. BY SAMUEL GARMAN. Published in the Bulletin of the Museum of Comparative Zoology, Vol. XVII, No. 2.

This valuable contribution to scientific literature, occupies some sixty pages and is amply illustrated with fifty-three plates. In this paper Prof. Garman describes and figures that peculiar system of canals and tubes, that lie in and beneath the skin of the head and body, called the lateral system, of the sharks, rays, etc. As these tubes contain a thin, mucilaginous fluid, they have been considered by some authors as the media for furnishing the mucous secretions found on the surface of the bodies of many of these animals. Prof. Garman, however, considers that they have quite a different function, answering, in fact to very delicate organs of sense, "receiving and carrying the slighter vibrations, noting the changes of density, currents, etc."

The system is worked out in some thirty-six genera, in some species of which it is very complicated, and the whole paper represents much patient and long-continued labor, the results of which, as here elaborated, reflect great credit upon the author.

In an author's extra extracted from the Auk for Oct., 1888 and Jan., 1889, Mr. Barton W. Evermann, gives acatalogue of the Birds of Carroll County, Indiana. Two hundred and three species are enumerated, a large list for any limited section in the United States. Interesting notes are appended to many of the species.

Mr. Frank M. Chapman, in an author's edition, extracted from the Bull. Am. Mus. Nat. Hist., Vol. II, No. 3, but issued June 7, 1889, describes two new species of White-footed Mice, Hesperomys floridanus and H. niveiventris. He also gives a new subspecies of Cotton Rat, which he calls Sigmodon hispidus littoralis, all from Florida. There are also some interesting notes on the Habits of the Round-tailed Muskrat, Neofiber alleni, as observed by Mr. Chapman, in Florida.

Under the title of The Nautilus, Messrs. H. A. Pilsbury and W. D. Averell, of Philadelphia, have begun a monthly publication devoted to the interests of conchologists. This journal is a continuation of the discontinued Conchologist's Exchange, and contains much interesting matter pertaining to the science that it represents.

NOTES AND CRITICISMS.

It is noticeable, that the larvæ of the locusts and grasshoppers in this vicinity, have not been as abundant this season as is usual, which may possibly be due to the small quantity of snow that we had last winter, the eggs being thereby deprived of their usual covering, must have perished.

On June 10th. of the present year, Mr. C. W. Chamberlain and myself secured a specimen of the Black Tern, Hydrochelidon nigra surnamensis, in full plumage, on the Sudbury River at Wayland, Mass., and another was obtained in the same locality about the same time, by Mr. Eastman, of Framingham. Both specimens were males. The occurrence of this species here in spring, is quite unusual, but it is not rare on the coast in autumn.

On the 10th of June, Mr Chamberlain and myself procured, also at Wayland, three young muskrats, Fiber zebethicus. They were in a nest that had evidently been newly built near the river, and as the meadows were flooded by the then recent heavy rains, was entirely surrounded. The little rats which were of three sizes and did not have their eyes open, were lying in a chamber, the walls of which were formed of green grass and reeds, plentifully mingled with half decayed roots and other debris, brought, from all appearances, from the bottom of the water. Everything about the nest was soaking, and the animals were lying on a bed that was equally wet, and that was placed not over two inches above the surface of the water. The chamber was oval in form, about a foot in diameter across the widest part, and the entrance to it opened directly into the water below. In view of the fact that the cavity of the winter houses of the muskrat is always placed at a sufficient elevation above the water to be dry, it is rather singular that the comparatively delicate young should be placed amid such moist surroundings. In spite of this, however, the little fellows were very warm indeed. But what was singular was the fact, that when I removed them to my house, I found that even when well supplied with coverings, that artificial heat was required to keep up anything like the original temperature. They fed quite readily upon milk. but although I gave them the greatest care, one died after another, the smallest and apparently the weakest specimen, surviving just one week, only long enough to get his eyes open. I have seen it stated, that the muskrats bring forth their young in burrows, but I was assured by Mr. Sherman who has lived near the Wayland marshes for many years, that he has on a number of occasions, found the young in the nests, and that they do not leave them for some time after they are able to run about. Strangely my little muskrats appeared perfectly helpless when put in water, in fact, could not swim as well as young kittens of the same age, hence it is possible that these rats do not acquire aquatic habits until at least half grown.

For many years in Massachusetts, there has been shown a commendable desire to protect our birds. This has been done largely with the idea that they were beneficial to the husbandman, but more largely, it appears to me, from a purely sentimental point of view, as it is today a mooted point, among ornithologists, as to whether certain birds, now protected by law, are really beneficial after all. For example is the common robin entitled to the absolute protection that the law affords it? Would it not be better to treat it as a game bird, with a close season a part of the year? In my mind, the whole matter requires investigation by experts, for the instruction of the Legislature.

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